A REVIEW OF THE AUSTRALIAN MOTH GENUS *THALAINA* (LEPIDOPTERA: GEOMETRIDAE: ENNOMINAE)

by P. B. McQuillan*

Summary

McQuillan, P. B. (1981) A review of the Australian moth genus *Thalaina* (Lepidoptera: Geometridae: Ennominae). *Trans. R. Soc. S. Aust.*, **105**(1), 1-23, 12 June, 1981.

The moth genera *Thalaina* Walker, *Thalainodes* Lower and *Macqueenia* Turner are reviewed. New evidence has resulted in an expansion of the concept of *Thalaina* to include the other genera in its synonymy. Nine species are reviewed and *T. kimba* sp. nov., is described from the mallee areas of South Australia and New South Wales. Immature stages, foodplants, flight activity and distribution of the various species are recorded where known. The genus has adapted successfully to most major habitats in the southern half of Australia wherever their food plants (*Acacia* and *Cassia*) are established.

Introduction

This is the first of a proposed series of taxonomic studies on the ennomine geometrids of southern Australia. It reviews the taxonomic status and known biology of a distinctive group of autumn-flying moths previously referred to *Thalaina* Walker, *Thalainodes* Lower and *Macqueenia* Turner.

All the species are large, strikingly patterned, nocturnal moths with distinctive larvae. Not surprisingly, all four species found in coastal eastern Australia were described by 1865. Residing at Broken Hill O. B. Lower discovered and described three inland species between 1900 and 1902, and his series of two of them constitute most of the specimens available for study. An apparently localised species was discovered in the 1930's at Millerran, southern Queensland by J. Macqueen and is still very poorly known. In the 1960's and early 1970's a few specimens of a widespread central Australian species were collected and subsequently described in 1972. Similarly, concentration of collecting in the semi-arid areas of southern Australia during late autumn by CSIRO collectors over the last ten years has made available a good series of another new species described here.

Methods

The following abbreviations are used for collections: AM = Australian Museum, Sydney; ANIC = Australian National Insect Collection, CSIRO, Canberra; BMNH = British Museum (Natural History), London; NMV = National Museum of Victoria, Melbourne; PBMcQC = P. B. McQuillan collection, Adelaide; QM = Queensland Museum, Brisbane; SAM = South Australian Museum, Adelaide; TDA = Tasmanian Department of Agriculture, Hobart; TMAG = Tasmanian Museum and Art Gallery, Hobart; UQ = University of Queensland, Brisbane; WAM = Western Australian Museum, Perth.

Abbreviations of the names of collectors are: PA = P. Aitken, FMA = F. M. Angel, EA = E. Ashby, WBB = W. B. Barnard, RB = R. Beresford, TB = T. Blackburn, TGC = T. G. Campbell, DHC = D. H. Colless, IFBC = I. F. B. Common, JRC = J. R. Cunningham, JWD = J. W. Davies, EJD = E. J. Dumigan, EDE = E. D. Edwards, BE = B. Evans, RHF = R. H. Fisher, CWF = C. W. Frazier, NG = N. Geary, GCLG = G. C. L. Gooding, GHH = G. H. Hardy, RJH = R. J. Hardy, JH = J. Harslett, CCI = C. C. Ives, WK = W. Kleczaj, LEK = L. E. Koch, LRK = L. R. Kurtze, AML = A. M. Lea, RL = R. Lewis, OBL = O. B. Lower, GL = G. Lyell, NMcF = N. McFarland, KJMcK = K. J. McKie, JM = J. Macqueen, PBMcQ = P. B. McQuillan, WLM = W. L. May, VHM = V. H. Minchin, BM = B. Mollison, GBM = G. B. Monteith, JGM = J. G. Morris, TN = T. Newberry, LJN = L. J. Newman, KRN = K. R. Norris, HP = H. Pelz, RJP = R. J. Priest, PR = P. Ranford, LMR = L. Mosse-Robinson, VJR = V. J. Robinson, ALR = A. L. Rogers, RS = R. Straatman, JJHS = J. J. H. Szent-Ivany, JGOT = J. G. O. Tepper, HST = H. S. Thirkell, LBT = L. B. Thorn, NBT = N. B. Tindale, HU = H. Udell, MSU = M. S. Upton, MMHW = M. M. H. Wallace, RW = R. Went, JOW = J. O. Wilson, RGW = R. G. Winks, FWJ = F. Wood-Jones.

* Division of Entomology, Dept of Agriculture Laboratories, St John's Ave, New Town, Tas. 7008.

Numbers prefixed by "G" accompanying the descriptions of immature stages relate to code numbers of specimens in the McFarland larval collection housed at the S.A. Museum, Adelaide; see McFarland (1979) for full details.

Genus *THALAINA* Walker

Thalaina Walker 1855, p. 659; Type species *Thalaina klenaea* Walker (=*Thalaina selenaea* (Doubleday)), by subsequent designation by Fletcher 1979, p. 202.

Absyrtes Guenée, 1857, p. 226; Type species *Absyrtes magnificaria* Guenée, by subsequent designation by Fletcher 1979, p. 1.

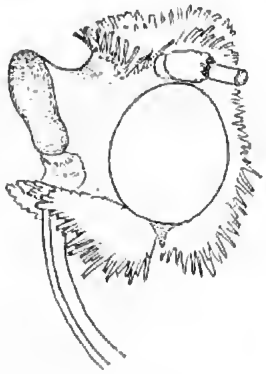
Thalainodes Lower 1902, p. 231; Type species *Amelora tetraclada* Lower, by subsequent designation by Turner 1919 p. 386; *syn. nov.*

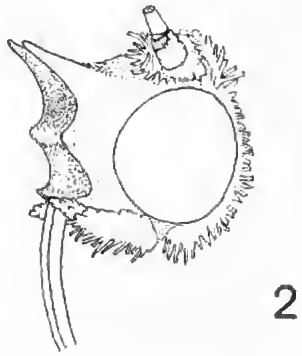
Macqueenia Turner 1947, p. 101; Type species *Macqueenia chionoptila* Turner, by monotypy; *syn. nov.*

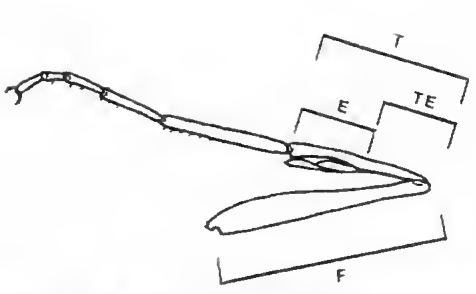
Adult: Medium sized, moderately robust, nocturnal moths; wing expanse 34–54 mm. Colour pattern basically white with or without darker geometrical markings.

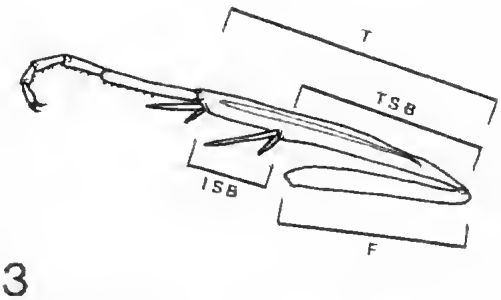
Head (Figs 1, 2) with vestiture of crown thick, hair-like slightly roughened; frons well rounded (fairly convex), clothed in scales, or nearly naked and bearing series of shallow transverse ridges beneath large sclerotized median projection; labial palp short, slightly porrect, second segment with projecting scales below, terminal segment very short; haustellum fully developed and functional; antenna in male laminate or strongly bipectinate, in female filiform; compound eye large, globular, without hairs; ocelli absent; chaetosemata present.

Thorax clothed with mixed hair-like and spatulate vestiture; forewing triangular, apex often subfalcate, in male without fovea, pattern usually white with ochreous geometrical pattern or rarely suffused darker, Sc and R_1 anastomosed, R_2 anastomosed with R_{3+4} to









3

Figs 1–2. Heads of *Thalaina* spp. 1. *T. tetraclada*; 2. *T. macfarlandi*.
Fig. 3. Fore and hind leg of *Thalaina* sp. E—length of epiphysis; F—length of femur; ISB—distance between spur bases; T—length of tibia; TE—distance from top of tibia to top of epiphysis; TSB—distance from top of tibia to top of spur base.

TABLE 1. *Comparison of some mean ratios from leg measurements of* Thalaina *species (see fig. 3 for abbreviations).*

		Fore leg			Hind leg		
	n	F/T	TE/T	E/T	F/T	TSB/T	ISB/T
selenaea ♂	3	1.51	0.56	0.45	0.68	0.66	0.28
angulosa ♂	3	1.50	0.53	0.45	0.66	0.67	0.28
clara ♂	3	1.75	0.60	0.48	0.68	0.64	0.33
inscripta ♂	3	1.77	0.61	0.44	0.71	0.67	0.28
allochroa ♂	3	1.51	0.28	0.46	0.78	0.67	0.27
paronycha ♀	2	1.59	0.29	0.35	0.86	0.69	0.22
kimba ♂	2	1.48	0.40	0.38	0.81	0.73	0.24
chionoptila ♂	2	1.60	0.51	0.55	0.68	0.66	0.27
tetraclada ♂	3	1.46	0.49	0.51	0.66	0.67	0.28
macfarlandi ♂	1	1.17	0.43	0.34	0.76	0.72	0.24

form an areole, R_5 stalked with R_{3+4}, M_2 often arising nearer to M_1 than to M_3; hindwing white, sometimes with darker markings, cell rather long; femora smooth-scaled, posterior tibiae in male slightly dilated, fore tibiae with epiphysis, sometimes with apical hook, mid and hind tibiae with spurs well developed (for leg measurements, see Table 1).

Abdomen with comb on segment 3 in male weakly to moderately developed.

Male genitalia with uncus simple, slender, apically acute; socii well developed, gnathos simple, slender, with small median recurved spine or group of small spines at apex; juxta broadly rectangular or shield-shaped; furca usually long, bifid; cristate hairs well developed; valva elongate, slightly spatulate; aedeagus tubular, slightly curved with pointed apex and oblique distal orifice, cornuti usually a series of stout, often compound spines.

Female genitalia with papillae anales densely hairy, bases of hairs set in conical projections; apophyses posteriores about 1.4 times as long as apophyses anteriores; sterigma broadly cup-shaped; ductus bursae long, with parallel sides, weakly sclerotized, in diameter about ½ that of corpus bursae, its posterior part usually with ring of longitudinal sclerotized striations; corpus bursae ovoid, without signa.

Egg broadly ovate, with or without darker marking.

First instar larva with head capsule brown, without pattern; body pale yellow; setae extremely long and quite stout; setae XD and D on prothorax on a lightly sclerotized plate; anterior humps on prothorax lacking. Abbreviated prolegs present on A4 and A5; crotchets arranged in complete circle on A4 and A5 (numbering about 12) and in half circles on A6 and claspers.

Final instar larva with head capsule green to yellow-green with numerous small brown blotches across vertex; labrum deeply emarginate; body fairly robust, pale green to dull green with at least a whitish lateral stripe; cuticle smooth; setae short and fine; prothorax somewhat swollen and produced into two anterior dorso-lateral fleshy projections; abbreviated prolegs present on A4 and A5; crotchets in 3/4 circle on A4, in 5/6 circle on A5 and ½ circle on A6 and claspers, uniordinal on A4–A6 but tending to be biordinal on claspers of some species; numbers of crotchets range: 13–21 on A4, 14–29 on A5, 25–37 on A6 and 28–48 on claspers; length 23–41 mm, width 4.5–5.5 mm; head capsule width 2.3–3.5 mm. The larvae are foliage mimics, being basically green in colouration with pale lateral and ventral stripes. Those species feeding on bipinnate *Acacia* usually have pale dorsal stripes and more mottled colouration.

Pupa dark brown to orange-brown; smooth, anterior margin of A10 dorsally with 2–4 widely rounded teeth; cremaster hooks 2 or 6–8; length 11–17 mm, width 5–6 mm. Aestivates in loose cocoon incorporating detritus, beneath litter or in the soil.

Flight Period: Mostly late summer to late autumn; flight periods for individual species range from less than four to more than twelve weeks. Figure 18 shows flight periods for species represented in collections by over 20 specimens with full data.

Distribution: Australia, south of about latitude 24°; see figs 49–51.

Key to adults:

1. Frons more or less naked, with sclerotized median projection 2
— Frons covered with hair-scales, without median projection 6
2. Forewing satiny-white with sharply defined orange-brown or ochreous brown markings 3
— Forewing mostly pale ochreous-grey or grey 5
3. Forewing with stripe along middle one-third of costa 4
— Forewing without stripe along middle one-third of costa ..... *macfarlandi* (Wilson)
4. Forewing with oblique stripe from near mid termen to costal streak at three-quarters ..... *paronycha* (Lower)
— Forewing without stripe connecting termen and costa as above ..... *tetraclada* (Lower)
5. Forewing completely ochreous-grey, minutely speckled with black ..... *allochroa* (Lower)

— Forewing white but heavily marked with broad, suffused grey markings *kimba* sp. n.

6. Forewing without markings in disc ... 7
— Forewing with markings in disc ... 8

7. Hindwing with a large black spot near tornus ... *chionoptila* (Turner)
— Hindwing without a large black spot near tornus *selenaea* (Doubleday) ... (form *punctilinea* Walker)

8. Forewing with short, ochreous brown streaks on M_1, M_2, CuA_1 and CuA_2 near termen ... *inscripta* Walker
— Forewing without markings at extremities of M_1, M_2, CuA_1 and CuA_2 ... 9

9. Forewing with a relatively straight stripe from tornus to near mid costa or a little below mid costa ... 10
— Forewing with stripe from tornus not reaching mid costa ... *angulosa* Walker

10. Forewing with diagonal stripe from mid termen to three-quarters of costa ... *clara* Walker
— Forewing without stripe from mid termen to costa as above ... *selenaea* (Doubleday)

Thalaina selenaea (Doubleday)

FIGS 4, 14, 18, 19, 29, 39, 49, 52, 53.

Callimorpha selenaea Doubleday 1845, p. 437, pl. 5, fig. 3.
Thalaina selenaea, Meyrick 1892, p. 653; Turner 1919, p. 387.
Thalaina klenaea Walker 1855, p. 660.
Pompeja australiaria Herrich-Schäffer 1855, pl. 60, fig. 333.
Absyrtes australiaria H.Sch. (*magnificaria* Gn.) var. *fortunata* Thierry-Mieg 1899, p. 21.
Absyrtes magnificaria Guenée 1857, p. 226.
Phalaena magnifica Desmarest 1858 *syn. nov.* (junior objective synonym of *magnificaria* Gn.).
Thalaina punctilinea Walker 1865, p. 228.

Type of *selenaea:* not found in BMNH (D. S. Fletcher, pers. comm.) or any Australian collections.

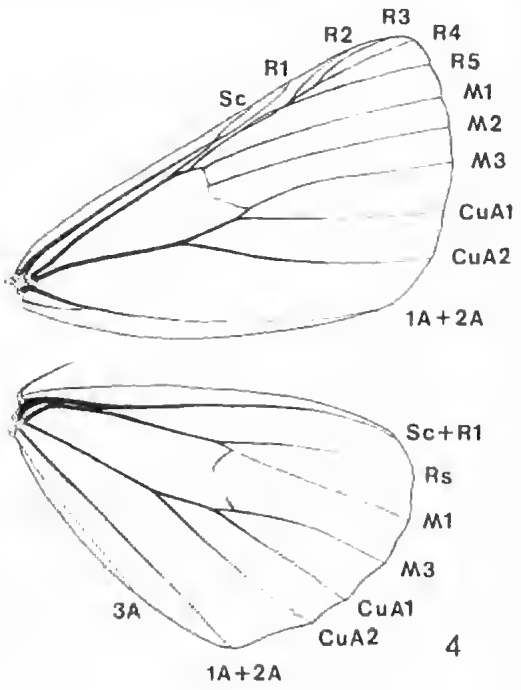
Types of *klenaea: lectotype* ♀ labelled "*Callimorpha selenaea* H. T. [Hobart Town] Australia 44–105" in BMNH, hereby designated; 1 ♂ *paralectotype* labelled "46–46" in BMNH, hereby designated.

Type of *australiaria:* not found in Zoological Institute, Martin Luther University, Wittenberg, GDR (N. Grosser, pers. comm.).

Holotype ♂ of *australiaria* var. *fortunata* labelled "Typicum specimen : Ex Musaeo Ach. Guenee : Magn. var A Gn. : Ex Oberthur Coll. Brit. Mus. 1927–3" in BMNH.

Type of *magnificaria:* this is the earliest scientific name and formal description of text-fig. 17 p. 5 of Lucas (1857), colloquially named by him as "Phalene magnifique" according to Guenée (1857) 4 ♂, 1 ♀ were in his collection at the time of description; none of these syntypes has been examined.

Type of *magnifica:* Desmarest applied this name to Lucas' unnamed figure; the specimen



Figs 4–5. Venation of *Thalaina* spp. 4. *T. selenaea*; 5. *T. chionoptila*.

on which the figure is based has not been examined.

Type of *punctilinea*: *lectotype* ♂ labelled "Tasmania 58–60" in BMNH, hereby designated; 1 ♀ *paralectotype* labelled "V.D.L., W.H.S. [or W.W.S.] 43–58" in BMNH, hereby designated.

Adult (figs 52, 53): Head with frons rounded, smoothly hair-scaled, whitish with fuscous band below vertex; vertex with erect hair-scales, bright red-brown; labial palp with terminal segment and apex of second segment fuscous, remainder white; antenna of male laminate. Thorax above greyish white on anterior margin, remainder white, base of wings orange, beneath white; legs white with exterior of fore and mid femur and tibia and all tarsi infuscated; forewing (fig. 4) with costa nearly straight, apex pointed, termen rounded and somewhat sinuate beneath apex, R_1 anastomosed with Sc, R_2 often anastomosed with R_3 to form an areole, ground colour above shining white, red-brown streak along costa from base to one-half thence angled inwards as a narrowly black-margined streak to tornus; similar streak from tornus along inner margin to near base, termen narrowly red-brown, cilia red-brown posteriorly fuscous; hindwings shining white, moderate fuscous subapical blotch, cilia white; forewings beneath shining white infuscated near apex and with costal streak fuscous; hindwings beneath shining white, subapical blotch much enlarged, sharply red-brown above M_1 fuscous below; wing expanse ♂ 48–54 mm, ♀ 52–56 mm.

A common variety of this species (fig. 53) has a reduced costal streak, lacks the diagonal forewing streak and has the streak along the inner margin poorly developed; the subapical hindwing blotch may be reduced or even absent but is fully developed beneath.

Male genitalia (fig. 19) with apex of gnathos with small spine, furca with two prongs of equal length; aedeagus (fig. 29) stout, cornuti of two compound spines subequal in length.

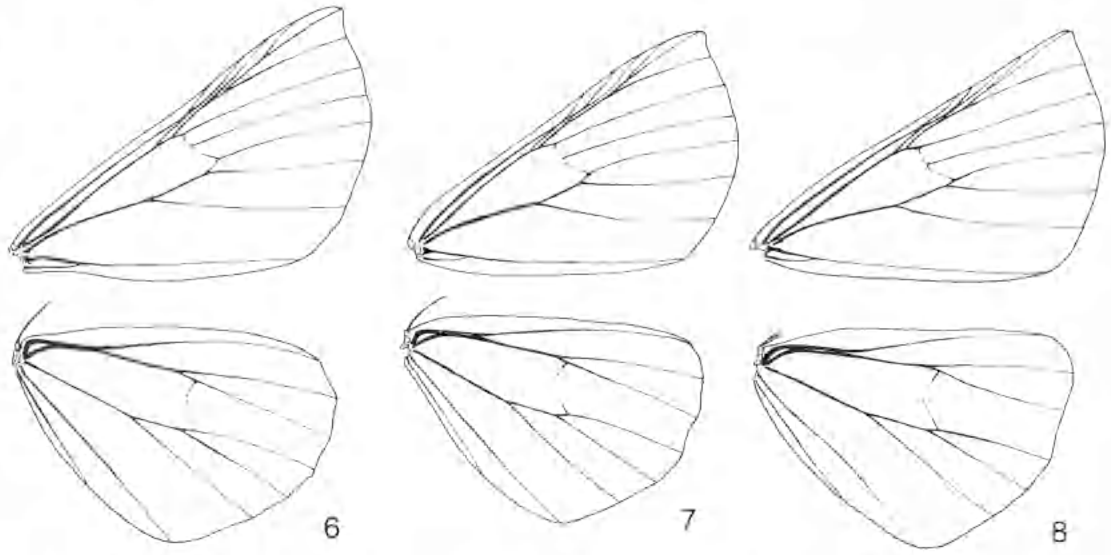
Female genitalia (fig. 39) with corpus bursae elbowed.

Final instar larva: Head capsule 3.3–3.5 mm wide, pale green with small fuscous blotches across vertex; body green with fine fuscous speckling on anal plate and claspers, fleshy whitish lateral stripe usually present, two white subventral stripes present as blotches adjacent to thoracic legs and continuous from metathorax to A9, incomplete white mid ventral stripe on A1 to A5; crochets 19–21 on A4, 22–29 on A5, 31–37 on A6 and 35–42 on anal claspers, crochets on anal claspers uniordinal; length 38–41 mm, width 5.5–6 mm. Material: G119.

Pupa (fig. 14) mid to dark brown in colour; cremaster hooks 6–8; dorsal anterior margin of A10 with 4 lobes. Material: G119.

Foodplants: *Acacia melanoxylon* R. Br., *A retinodes* Schlecht.

Specimens examined: 83 ♂ 45 ♀. QUEENSLAND: Brisbane, v. RGW 1 ♀ UQ; Lamington Ntl Park, ii., v. WK 2 ♂ UQ; Stanthorpe, iv. 1 ♂ UQ; Toowoomba, iii., iv. EJD 2 ♂ UQ; Wyberba, iii. IFBC 1 ♂ ANIC. NEW SOUTH WALES: Brown Mountain, i. DHC 1 ♂ ANIC; 8 km N of Bungwahl, iii. IFBC & MSU 1 ♂ ANIC; Church Point, v. IFBC 1 ♂ ANIC; Clyde Mtn 800 m, iii. IFBC & MSU 1 ♂ ANIC; 8 km W of Coff's Harbour, v. MSU 1 ♂ ANIC; Depot Beach, iv. IFBC 1 ♂ ANIC; Kangaroo Valley, iii. DHC 1 ♂ ANIC; Katoomba, iii. 1 ♂ SAM; Narara, iv. LMR 1 ♂ ANIC; 5 km SSE of Port Macquarie, v. MSU 1 ♂ ANIC; 2.7 km NE of Queanbeyan 670 m, iv. IFBC 1 ♀ ANIC; 40 km S of Singleton, iii. IFBC 1 ♂ ANIC; Tooloom Scrub, iii. 1 ♂ UQ; 8 km S of Wauchope, iii. IFBC & MSU 1 ♂ 1 ♀ ANIC; Wollongong, iii. VJR 1 ♂ ANIC. AUSTRALIAN CAPITAL TERRITORY: 1.6 km NE of Lee's Spring 1300 m, i. IFBC 1 ♂ 1 ♀ ANIC. VICTORIA: Boronia, iv. 1 ♂ NMV; Castlemaine, iii. 1 ♀ 8 km S of Gellibrand 230 m, ii. IFBC 1 ♀ ANIC; Gisborne, iii., iv. 4 ♂ 3 ♀ ANIC, iv. 68 specimens NMV, i., iii., iv. GL 14 ♂ 4 ♀ SAM; Meenijan, iv. 1 ♀ NMV; Mitcham, iv. 1 ♂ 4 ♀ NMV; Moe, iv. 1 ♀ NMV, iii. GCLG 1 ♀ SAM; Mordialloc, v. CCI 1 ♂ ANIC; Mt. Difficult Rn., ii. IFBC 1 ♂ ANIC; Springvale, v. 1 ♀ UQ; Turton's Pass, iii. NBT 5 ♂ 1 ♀ SAM; Wandin, iv. 1 ♀ NMV. TASMANIA: Condominion Creek, ii. 1 ♂ 2 ♀ NMV; Cracroft Crossing, ii. 1 ♀ NMV; Devonport, 1 ♂ TDA; Freycinet Ntl Park, ii. IFBC & MSU 1 ♂ ANIC; Kelso, 1 ♂ SAM; Kingston, iii., iv. JRC 2 ♂ ANIC, iv. JRC 2 ♀ NMV; Lake Leake 660 m, ii. IFBC & MSU 1 ♂ ANIC; Launceston, iv. 1 ♂ SAM; 16 km W of Maydena, ii. 1 ♂ 4 ♀ NMV; Mt Nelson 200 m, ii., iii. PBMcQ 4 ♂ TDA; Mt Wellington 280 m, i., ii., iii. BM 7 ♂ 4 ♀ ANIC; Ouse, ii., iii., iv. 3 ♂ 1 ♀ TDA; Parenna, King Island, ii. PBMcQ 1 ♂ TDA; Queenstown, v. 1 ♀ NMV; Ridgeway, iv. JRC 1 ♂ 2 ♀ NMV; Roseberry, ii. 1 ♀ ANIC; Sandford, WLM 1 ♂ ANIC; 5 km E of Waratah 660 m, ii. IFBC & MSU 2 ♂ 1 ♀ ANIC; 13 km SW of Waratah 600 m, ii. IFBC & MSU 2 ♂ 1 ♀ ANIC; Zeehan, i. GHH 1 ♂ ANIC, ii. 1 ♂ 1 ♀ NMV. SOUTH AUSTRALIA: Furner, v. 3 ♂ SAM; Naracoorte, 1 ♀ SAM; Yorke Peninsula, iii., iv. JGOT 1 ♂ 1 ♀ SAM.



Figs 6–8. Venation of *Thalaina* spp. 6. *T. angulosa*; 7. *T. clara*; 8. *T. inscripta*.

Distribution: see fig. 49. Flight Period: see fig. 18.

Comments: T. selenaea is a dimorphic species — one form (var. *punctilinea* Walker) without markings on the forewing and the other with a diagonal bar across the forewing; occasionally a streak along M_3 may also be present (fig. 52). It occurs in habitats in south eastern Australia from open woodland to closed forest in areas of greater than 75 cm annual rainfall and at elevations of 0–800 m. Preferred hosts are large phyllodinous wattles such as *Acacia retinodes* and *A. melanoxylon*. An interesting dwarf population occurs in remnant native forest near Parenna on King Island. This species is the earliest of the genus to appear on the wing, flying from mid January to April.

Thalaina angulosa Walker

FIGS 6, 13, 15, 18, 20, 30, 40, 50, 54.

Thalaina angulosa Walker 1865, p. 289; Meyrick 1892, p. 665; Turner 1919, p. 388.

Holotype ♀ without abdomen, labelled "S. Aust. 61–104" (F. Waterhouse) in BMNH.

Adult (fig. 54): Head with frons rounded, smoothly hair-scaled, whitish-buff; vertex with rough hair-scales, orange; labial palpi with terminal segment and apex of second segment fuscous, remainder of second segment white; antenna of male shortly bipectinate. Thorax above greyish-white becoming whiter posteriorly and on tegulae, orange at base of wings, white beneath; legs with fore and mid femora and all tarsi infuscated, hind femora and tibiae whitish; forewing (fig. 6) with costa nearly straight, apex produced, termen strongly arched and sinuate below apex, R_1 anastomosed with Sc, ground colour above shining white, a narrowly black-margined rust coloured streak along costa from base to one-eighth costa then extending to mid-discal area where it divides into an upper arm reaching mid termen thence to four-fifths costa and a lower arm extending to tornus thence along the posterior margin to near base, termen narrowly rust coloured, cilia rust posteriorly fuscous; hindwing shining white, a large fuscous subterminal blotch extending from above M_3 to near apex with a narrower extension to anal angle, cilia fuscous on termen from anal angle to five-sixths with remainder white; forewing beneath shining white with upper markings visible, a subapical blotch extending from four-fifths costa to mid termen, orange-rust near costa, remainder fuscous becoming paler apically; hindwing beneath shining white, subterminal blotch as above but less extensive and sharply orange-rust above M_1; wing expanse ♂ 40–48 mm, ♀ 42–54 mm. Abdomen white.

Male genitalia (fig. 20) with apex of gnathos bearing a small spine; aedeagus (fig. 30) rather stout, cornuti of two compound spines.

Female genitalia (fig. 40) with ductus bursae swollen proximally.

Egg: Ovoid, greenish, without markings; stimulated to hatch by rainfall. See McFarland 1971, p. 242 for full details. Material: G100.

Final instar larva: Head capsule 3.3 mm wide, greenish with numerous small brown blotches some of which form suffused band across vertex; body bright green with dark speckling on dorsum of prothorax, on anal plate and on claspers; yellowish-white lateral stripe often heavily edged with fuscous on its lower margin, sometimes four faint parallel whitish lines dorsally, two whitish subventral stripes present and incomplete mid ventral stripe on A1 to A6, bases of setae inconspicuous, crotchets 16–19 on A4, 20–22 on A5, 29–30 on A6 and 33–38 on anal claspers; length 36–40 mm, width 4.5–5.5 mm. Material: G100.

Pupa (fig. 15) mid brown in colour; cremaster hooks 2; dorsal anterior margin of A10 with 2 lobes. Material: G100.

Foodplants: Predominantly *Acacia pycnantha* Benth.; also recorded from *A. brachybotrya* Benth. and *Cassia ?nemophila* A. Cunn. (McFarland 1979).

Specimens examined: 113 ♂ 77 ♀. QUEENSLAND: Stanthorpe, iv. JH 1 ♂ SAM; Talwood, iv, WBB 1 specimen QM. NEW SOUTH WALES: 1 km NNW of Goolgowi, v. IFBC & MSU 1 ♀ ANIC; 10 km SE of Gol Gol, v. IFBC 1 ♂ 1 ♀ ANIC; Tea Tree Creek nr Armidale, v. CWF 1 ♂ ANIC. VICTORIA: Birchip, iv. 8 specimens NMV, iv. 1 ♂ SAM; Gippsland, 1 ♀ NMV; Gisborne, iv. 1 ♀ NMV, iv. GL 1 ♀ SAM; Hamilton, 1 ♀ NMV; Hochkirch, iv. LRK 1 specimen QM; Melbourne, 1 ♀ SAM; Springvale, v. 1 ♀ NMV. SOUTH AUSTRALIA: Adelaide, iv., v. JGOT 1 ♂ 1 ♀ SAM, v. 1 ♂ SAM, v. EA 3 ♀ SAM; Aldgate, v. 1 ♀ SAM; Athelstone, iv., v. JHS 2 ♂ 2 ♀ SAM; Belair, iv. FMA 1 ♀ SAM; Blackwood, v. NBT 1 ♂ 1 ♀ ANIC, iii., iv., v. NMcF 2 ♂ 3 ♀ ANIC, iii., iv., v. NBT 20 ♂ 11 ♀ SAM, iv. VHM 1 ♀ SAM, iv. EA 1 ♀ SAM, v. EA 1 ♀ SAM, v. OBL 1 ♂ 5 ♀ SAM; Bowhill, iv. FMA 1 ♀ SAM; Burnside, 1 ♀ SAM; 100 km E of Ceduna, v. IFBC & MSU 2 ♂ ANIC; Glen Osmond, v. FMA 1 ♀ SAM; Highgate, iv. 1 ♂ SAM; Kadina, v. 1 ♀ PBMcQC; Lynton, iv., v. RHF 3 ♂ ANIC, iv. RHF 4 ♂ 4 ♀ SAM; Mambray Creek Nat. Pk., v. IFBC 1 ♀ ANIC; Monarto South, v. JWD 1 ♂ SAM; 48 km ESE of Morgan, v. IFBC & MSU 1 ♀ ANIC; Mt. Lofty, AML 1 ♀ SAM; Parkside, OBL 1 ♀ SAM, iv. FMA 1 ♂ SAM; Port Lincoln, 1 ♀ SAM; Renmark, v. PBMcQ 1 ♀ PBMcQC; Stonyfell, v. FMA 1 ♀ SAM; Waikerie, iv. 1 ♀ SAM; Warradale, iv., v. PBMcQ 4 ♂ 3 ♀ PBMcQC; 10 km SW of Wilmington, v. IFBC & MSU 1 ♂ ANIC; Whyalla, v. 1 ♀ NMV; 48 km S of Whyalla, v. IFBC 3 ♂ 3♀ ANIC. WESTERN AUSTRALIA: Brunswick Inlet, 1 ♂ WAM; Burngup, 1 ♀ WAM; Cape Naturaliste, iv. IFBC & MSU 2 ♂ ANIC; Carlingup, v. 1 ♀ WAM; Claremont, 1 ♂ WAM; 26 km N of Collie, iv. IFBC & MSU 1 ♂ ANIC; 21 km WSW of Collie, iv. IFBC & MSU 2 ♂ ANIC; 27 km SE of Coolgardie, iv. IFBC & MSU 2 ♂ ANIC; Corrigin, 1 ♂ WAM; Crawley, vi. KRN 1 ♂ ANIC; Denmark, iii., iv. WBB 2 specimens QM; Drummond Cove 11 km N of Geraldton, v., vi. NMcF 5 ♂ ANIC; Dumbleyung 1 ♀ WAM; Dundas, 1 ♀ SAM; Hamel, v. 1 ♂ NMV; Katanning, v. KRN 1 ♀ ANIC; 1 ♂ ♀ WAM; Kojonup, iv., v., vi. ALR 8 ♂ 2 ♀ ANIC, iv., v. RJP 9 ♂ ANIC, iv., v. MMHW 6 ♂ ANIC, 1 ♀ SAM; Lake Grace, iv. 1 ♀ ANIC, iv. 3 specimens QM; 45 km W of Madura, iv. IFBC & MSU 2 ♂ ANIC; 29 km W of Mogumber, iv. IFBC & MSU 4 ♂ ANIC; 98 km E of Norseman, iv. FBC & MSU 2 ♂ ANIC, 24 km N of Northampton, iv. IFBC & MSU 3 ♂ ANIC; 11 km S of Pemberton, iii. IFBC & MSU 1 ♂ 1 ♀ ANIC; Perth, v., viii, 1 ♂ 1 ♀ NMV; Pithara, iv. IFBC & MSU 1 ♂ ANIC, v. 1 ♀ WAM; Ravenswood, vi. FMA 3 ♂ 2 ♀ SAM; Stockyard Gully, Jurien Bay, vi. BE 1 ♀ WAM; Swan River, vii. 1 ♂ QM; Tammin, v., vi. 9 specimens NMV; Yanchep Nat'l Pk, iv. IFBC & MSU 2 ♂ ANIC; Yuna, iv. IFBC & MSU 2 ♂ ANIC.

Distribution: see fig. 50. *Flight Period:* see fig. 18.

Comments: T. angulosa is widespread in dry sclerophyll forest and mallee areas in South and Western Australia extending to wet sclerophyll forest in southwestern Australia. However it is rare in this habitat further east. It is sympatric with *T. tetraclada* over a large part of its range. A favoured habitat is the open woodland of the Mt Lofty Ranges where *Acacia pycnantha* is commonly a dominant or co-dominant shrub. Adults emerge after a succession of cold nights in mid autumn and persist until late May.

Thalaina clara Walker

FIGS 7, 16, 18, 21, 31, 41, 50, 55.

Thalaina clara Walker 1855, p. 660; Meyrick Meyrick 1892, p. 654; Turner 1919, p. 388.

Holotype ♂ labelled "Australia 52-39" in BMNH.

Adult (fig. 55): Head with frons rounded, smoothly hair-scaled, whitish-buff; vertex roughly hair-scaled, rust colour; labial palpi with terminal segment and apex of second segment fuscous, remainder white; antenna of male laminate. Thorax white, anteriorly grey-white, orange at base of wings; legs with fore and mid femora and tibiae and all tarsi infuscated, hind femora and tibiae white; fore-

wing (fig. 7) with costa straight, gently arched apically, termen arched and slightly sinuate beneath apex, R_1 anastomosed with Sc and again with R_2, ground colour shining white; narrowly black-margined red-brown streak from base to one-third costa then angled to mid-discal area where it bifurcates emitting one streak to tornus thence along posterior margin to near base and another streak tracing M_3 to mid termen then back to four-fifths costa, termen narrowly light fuscous, cilia orange posteriorly fuscous; hindwing shining white with a rounded fuscous subapical blotch never extending to anal angle, cilia white; forewing beneath white, costa and a triangular subapical blotch fuscous, costal edge of this blotch orange; hindwing beneath white, subapical blotch usually larger than on upperside and orange above M_1; wing expanse ♂ 38–48 mm, ♀ 40–48 mm. Abdomen white.

Male genitalia (fig. 21) with apex of gnathos with small spine; aedeagus (fig. 31) with cornuti of two compound spines one noticeably longer than other.

Female genitalia (fig. 41) with sclerotised section of ductus bursae longer than colliculum.

Final instar larva: Head capsule 3.2 mm wide, blue-green with small fuscous blotches on upper half; body bright olive green with four wavy whitish lines dorsally; enclosed green areas irregularly mottled with blue-green, extreme posterior margin of each segment whitish; fleshy yellowish lateral line irregularly edged with pinkish and fuscous below, lateral areas mottled with white and finely speckled black, two whitish subventral stripes on most segments and diagonally extended to thoracic legs and prolegs, ventral areas pale green with several whitish parallel lines; crotchets 13–16 on A4, 15–19 on A5, 25–28 on A6 and 28–33 on anal claspers; length 33–37 mm, width 4.5–5.0 mm. Material: G128.

Pupa (fig. 16) dark brown in colour; cremaster hooks 6; dorsal anterior margin of A10 with 2 lobes. Material: G128.

Foodplant: Acacia decurrens (J. Wendl.) Willd.

Specimens examined: 117 ♂ 57 ♀. QUEENSLAND: Blackbutt, 1 ♀ UQ; Millmerran, v. IM 1 ♀ ANIC, v, 2 ♀ NMV, iv. JM 1 ♂ UQ; Toowoomba, iv. 2 ♂ 1 ♀ NMV, iii,, iv., v., viii. EJD 9 ♂ 4 ♀ UQ, v. JGM 1 ♀ UQ; NEW SOUTH WALES: Audley, v. HST 1 ♂ ANIC, Barrington House via Salisbury, v. GBM 1 ♀ UQ; Barryrene, iv. HST 1 ♀ ANIC; 8 km N of Bungwahl, iii IFBC & MSU 1 ♂ ANIC; Church Point, v. IFBC 1 ♀ ANIC; 7 km SW of Gosford, iii. IFBC & MSU 4 ♂ ANIC; Hornsby, iv. 2 ♂ 2 ♀ NMV; Killara, iv., v. 3 ♂ 1 ♀ NMV; Marulan, iv. 1 ♀ SAM; Millagong, iv. 2 ♂ 2 ♀ NMV; Mulgoa, LMR 1 ♂ ANIC; Narara, iv. LMR 4 ♂ 6 ♀ ANIC; National Park, iv. 1 ♂ NMV; Orange, ii. HST 1 ♂ 1 ♀ ANIC; Pine Creek via Coff's Harbor, v. GBM 1 ♂ UQ; Roseville, iv. LMS 5 ♂ ANIC; 40 km S of Singleton, iii. IFBC 1 ♂ ANIC; Sydney, iv. 1 ♀ NMV; Tooloom Scrub, iii. EJD 2 ♂ ANIC; ii., iii. EJD 7 ♂ 1 ♀ UQ; Tubrabucca Creek, Barrington Tops, i. RS 1 ♂ ANIC, i. 1 ♂ NMV; 8 km S of Wauchope, iii. IFBC & MSU 1 ♂ ANIC; 15 km NE of Windsor, iii. IFBC & MSU 1 ♂ 1 ♀ ANIC. AUSTRALIAN CAPITAL TERRITORY: Black Mountain, ii., iii. IFBC 5 ♂ ANIC, iii. IFBC 1 ♂ UQ; Canberra, iv. IFBC 1 ♀ ANIC; Condor Creek 800 m, ii. IFBC 1 ♀ ANIC, 3 km N of Lee's Spring 1200 m, ii. IFBC & EDE 1 ♂ ANIC. VICTORIA: Balwyn, xi. 1 ♂ NMV; Betka River, Mallacoota, iii. 1 ♀ NMV; Canterbury, iv. 10 specimens NMV, v, 1 ♂ SAM; Castlemaine, iii. 1 ♂ NMV; Cheltenham, iv. 20 specimens NMV; Crib Point, iv. CCI 3 ♂ 2 ♀ ANIC; Dandenong, iv. 9 specimens NMV; Gisborne, iii., iv. GL 20 specimens NMV, iii., iv. GL 5 ♂ 1 ♀ SAM, iv. GL 1 ♂ UQ; Hazelwood, iv. JHC 1 ♂ ANIC; Macedon, xi., iii. 2 ♀ NMV; Melbourne, OBL 2 ♂ 1 ♀ SAM; Mitcham, iv. 5 ♂ 1 ♀ NMV; Moe, iii., iv. GCLG 1 ♂ 3 ♀ ANIC, iv. RW 2 ♂ ANIC, iv. GCLG 2 ♂ SAM, iv, 1 ♂ UQ; Mt Donna Buang, i. 1 ♂ NMV; Mt Erica, ii. 1 ♀ NMV; Mt Waverley, 1 ♂ NMV; Myrtleford, iv. 1 ♂ NMV; Oakleigh, 1 ♀ NMV; Otway Ranges, ii. PBMcQ 4 ♂ 1 ♀ PBMcQC; Sale, iv, 2 ♂ NMV; Springvale, iv., v. 6 specimens NMV, v. 1 ♂ SAM, iv. LBT 1 ♂ UQ; Tara Valley Natl Park, ii. PBMcQ 2 ♀ PBMcQC; Thurra River nr. Cape Everard, iii. 1 ♂ NMV; Traralgon, iv. 2 ♂ 2 ♀ NMV; Wakroanga, iv., 1 ♀ SAM; Wandin, 2 ♂ NMV; Woori Yallock, iii. 1 ♂ NMV. TASMANIA: Mole Creek, iv, JRC 2 ♂ TMAG. SOUTH AUSTRALIA: Adelaide, OBL 2 ♂ SAM; Naracoorte, iii,, iv. IOW 1 ♂ 3 ♂ ANIC; Woodville, ix. TB 1 ♂ SAM.

Distribution: see fig. 50. *Flight Period:* see fig. 18.

Comments: T. chira ranges over much of the same type of habitat as *T. selenaea*, however its presence in Tasmania and near Adelaide requires confirmation.

Thalaina inscripta Walker

FIGS 8, 18, 22, 32, 42, 50, 56.

Thalaina inscripta Walker 1855, p. 661; Meyrick 1892, p. 655; Lower 1893, p. 290 (Java); Turner 1919, p. 388.

Phusargyria principaria Herrich-Schäffer 1855, pl. 78, fig. 446.

Absyrtes principiaria Herrich-Schäffer, Guenée 1857, p. 227.

Thalaina hieroglyphica Lower 1893, p. 289, Goldfinch 1944, p. 191.

Types of *inscripta*: *lectotype* ♂ labelled "V.D.L. 51–153" in BMNH, hereby designated, 1 ♂ 1 ♀ *paralectotypes*, 1 ♂ labelled "V.D.L. 54–9" in BMNH, hereby designated, 1 ♀ labelled as for lectotype, in BMNH, hereby designated.

Type of *principaria*: not in Zoological Institute, Martin Luther University, Wittenberg, GDR (N. Gosser, pers. comm.).

Holotype ♂ of *hieroglyphica* labelled "April '93, 906 Blackwood : 906 *T. hieroglyphica* Lower" in SAM.

Adult (Fig. 56): Head with frons rounded, smoothly hair-scaled, whitish-buff; vertex with rough hair-scales, pale fuscous; labial palp with terminal segment and most of second segment pale fuscous, second segment beneath with long white scales; antenna of male laminate. Thorax grey-white becoming whiter posteriorly, pale fuscous at base of wings; forewing (fig. 8) with costa nearly straight, apex produced; termen strongly arched and sinuate beneath apex; R_1 anastomosed with Sc and again with R_2; shining white markings ochreous to pale fuscous, narrowly margined darker; streak from base to one-third costa, then extending to mid disc where it bifurcates into an upper arm reaching mid termen thence to costa at three-quarters, and a lower arm reaching to tornus, thence thickly along posterior margin to base, termen with small semi-circular markings at the extremities of M_{3}, CuA_{1}, and CuA_{2} and a larger triangular blotch below apex, cilia pale fuscous; hindwing shining white with a moderate fuscous subapical blotch sometimes extending to termen and costa; forewing beneath white with upper-side markings visible; costal half of these being faintly outlined with pale fuscous below; hindwing beneath white, subapical blotch reproduced and usually larger; wing expanse ♂ 38–44 mm, ♀ 40–42 mm. Abdomen white with pale fuscous shadings above.

Male genitalia (fig. 22) with tegumen rather narrow; aedeagus (fig. 32) with cornuti of two subequal compound spines.

Female genitalia (fig. 42) with papillae anales rather large; ductus bursae relatively short.

Final instar larva: (modified from Lower 1893). Length 26 mm. Head capsule 2.3 mm wide, pale green with small fuscous blotches across upper frons; body green, lightly flecked darker, a mid dorsal stripe of dense blackish speckling; two fine dorsolateral whitish stripes; fleshy whitish lateral line irregularly blotched with fuscous above and below; a thin whitish subventral stripe; ventrally pale green with a white mid ventral stripe; crotchets 13–14 on A4, 12 on A5, 25 on A6 and 28–29 on anal claspers. Material: One specimen "Tas., 15 km NNW of Buckland, 19 viii. 1980, On *Acacia mearnsii* De Wild. P. B. McQ.", in TDA.

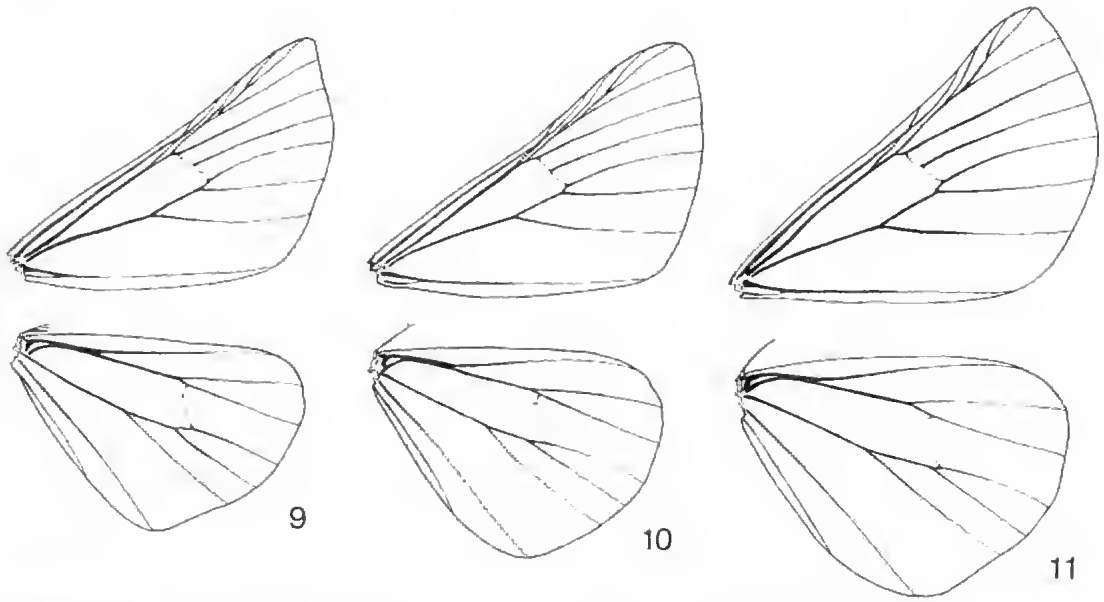
Pupa: mid brown in colour; 6 cremaster hooks; dorsal anterior margin of A10 with 2 lobes. Material: One specimen labelled as above, but "pupa 3 ix. 1980", in TDA.

Foodplants: *Acacia decurrens* (J. Wendl.) Willd., *A. mearnsii* De Wild.

Specimens examined: 58 ♂ 21 ♀. QUEENSLAND: Yeppoon, i. IFBC 1 ♀ ANIC; NEW SOUTH WALES 1.6 km S of Mt Tinderry 1600 m, ii. IFBC & MSU 1 ♂ ANIC; 5 km SE of Pilot Hill, Bago Forest, Barlow, iii. TGC 1 ♂ ANIC; AUSTRALIAN CAPITAL TERRITORY: Blundell's Creek Rd, 1000 m iii. IFBC 1 ♂ ANIC; VICTORIA: Bendigo, iv. 1 ♀ NMV; Castlemaine, iv. 4 ♂ 1 ♀ NMV; Gippsland, iii., iv. 30 specimens NMV; Gisborne, iii., iv. 4 ♂ 2 ♀ SAM, iii., iv. 30 specimens NMV; Macedon, iii. 2 ♂ NMV; Melbourne, iv. 1 ♂ NMV; Toolangi, iv. 3 ♂ 1 ♀ NMV; Wandin, iv. 5 specimens NMV. TASMANIA: Bellerive, iii. BM 1 ♂ ANIC; Cressy, iv. 1 ♂ TDA; Fern Tree iii. RJH 1 ♂ TDA; Hellyer Gorge ii. IFBC & MSU 1 ♀ ANIC; Kingston iv. JRC 2 ♀ UQ, iv. JRC 2 ♂ ANIC, iv. JRC 2 ♂ 4 ♀ TMAG; iv. JRC 1 ♂ NMV; L. Leake 1300 m, ii. IFBC & MSU 1 ♀ ANIC; 16 km W of Maydena, ii. 1 ♂ NMV; Mt Barrow 800 m, iii. IFBC & MSU 1 ♂ ANIC; Mt Field National Park 160 m, ii. IFBC & MSU 1 ♂ ANIC; Mt Nelson 200 m, iii., iv. PBMcQ 5 ♂ 3 ♀ TDA; Mt Wellington 270 m, i., ii., iii., iv., BM 15 ♂ 5 ♀ ANIC; Ouse, iii., iv. 3 ♂ TDA; Pyengana 310 m, iii. IFBC & MSU 2 ♂ 1 ♀ ANIC; Ridgeway, ii. 1 ♂ NMV; Trevallyn, iii. RJH 1 ♂ TDA; 21 km S of Westbury iii. IFBC & MSU 1 ♂ ANIC.

Distribution: see fig. 50. *Flight Period*: see fig. 18.

Comments: *T. inscripta* is an interesting species with larvae adapted in colour pattern to living on bipinnate *Acacia* food plants. It is the most cold-tolerant of the genus, being the commonest species over much of Tasmania where it occurs in open woodland up to 1000 m; it also occurs in the Australian Alps up to 1500 m. The single record from central Queensland is noteworthy in view of the ab-



Figs 9–11. Venation of *Thalaina* spp. 9. *T. paronycha*; 10. *T. allochroa*; 11. *T. kimba*.

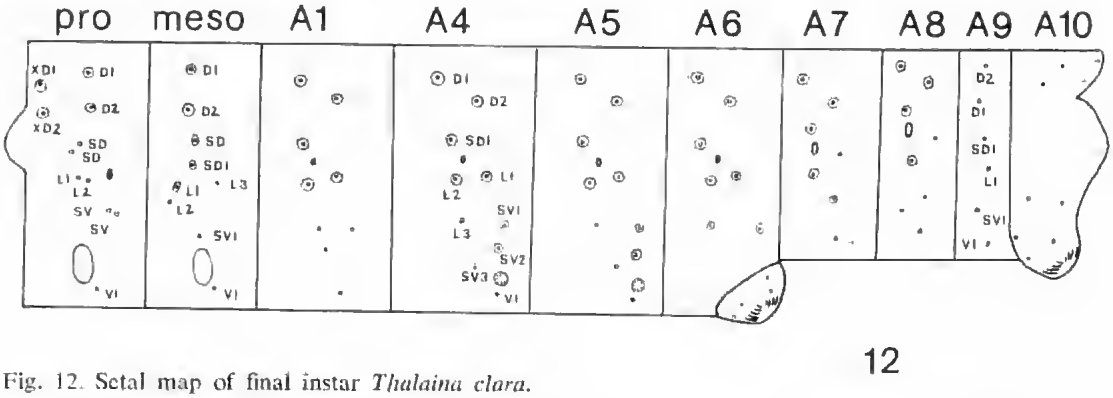


Fig. 12. Setal map of final instar *Thalaina clara*.

sence of records from northern N.S.W. and southern Queensland.

Adult moths were abundant in an open eucalypt woodland in which *Acacia mearnsii* was the dominant tall shrub about 8 km south of Steppes, central Tasmania, on 6 iii. 1980. In the mid-afternoon sunshine months were resting on the undersides of *Acacia* leaves sometimes two or three per tree, and were readily put to flight by walking near them. Their flight was extremely erratic and sustained; and generally less than 5 m above the ground. Although conspicuous in flight, they were not easy to see at rest on the trees in the dappled light when looking against the sky.

Thalaina chionoptila (Turner) comb. nov.
FIGS 5, 18, 23, 33, 43, 49, 57.

Macqueenia chionoptila Turner 1947, p. 102. *Types: lectotype* ♂ labelled "Milmerran, Q. 25 APR. 1936 J. Macqueen : Macqueenia chionoptila Turn. TYPE" in ANIC, hereby designated: 4 ♂ 4 ♀ *paralectotypes*, 1 ♂, 3 ♀ "Milmerran, Q. 14–5–31 J. Macqueen", 1 ♂ "Milmerran, Q. 27–4–31 J. Macqueen", 1 ♂ Milmerran, Qld. 27 APR. 1935 J. Macqueen", 1 ♂ Milmerran, Qld. 8 May 1935 J. Macqueen", 1 ♀ "Milmerran, Q. 20–4–31 J. Macqueen : Genitalia M818 P.B. McQ. 1978" in ANIC, hereby designated.

Adult (fig. 57): Head with frons rounded, smoothly scaled, whitish buff; vertex with erect hair-scales, bright red-brown; labial palp buff, becoming whitish towards base of second segment; antenna of male strongly bipectinate.

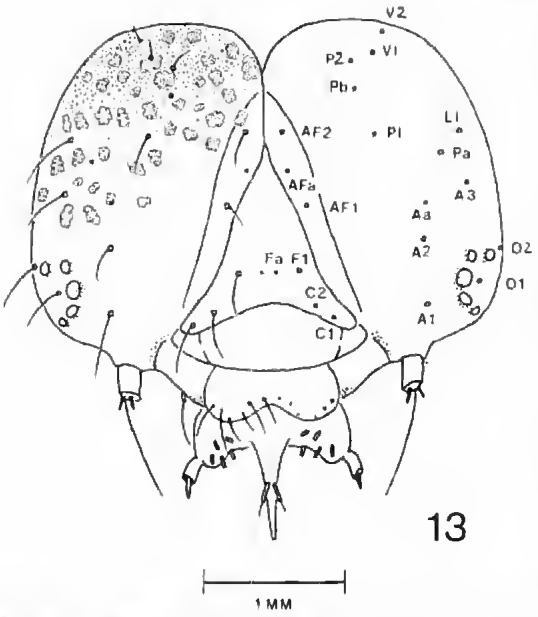
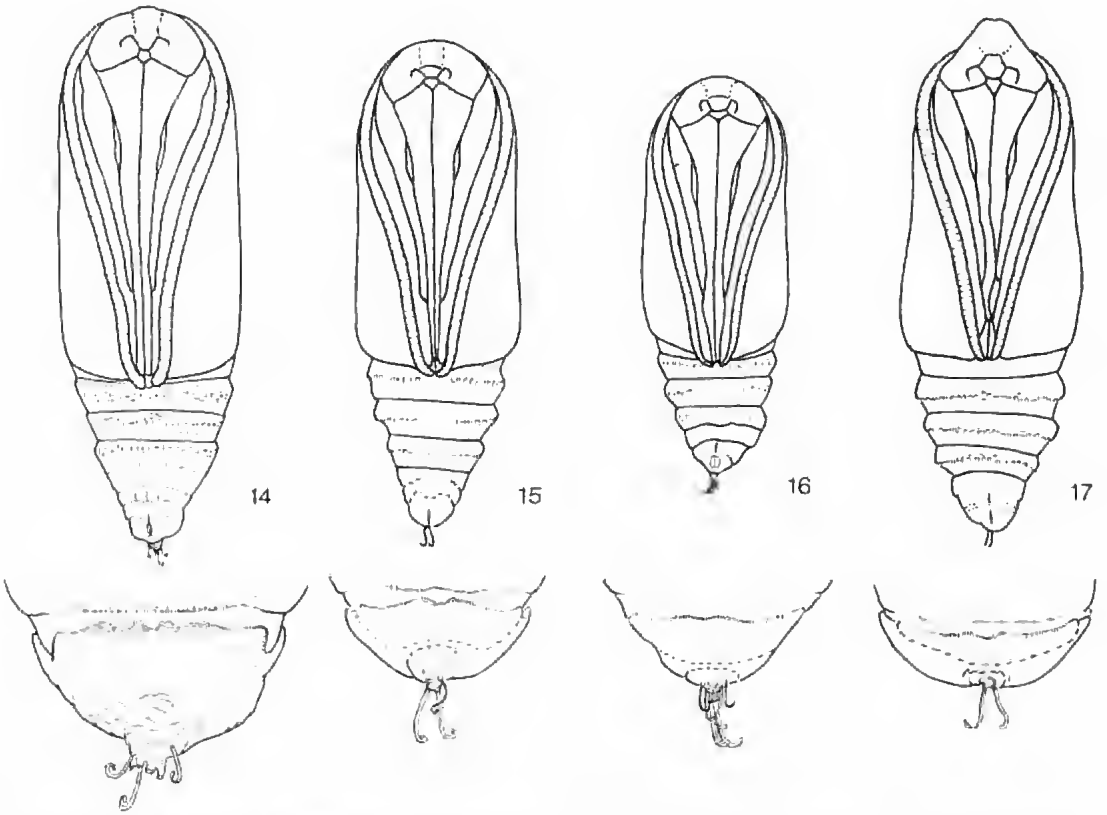


Fig. 13. Head capsule of final instar *Thalaina angulosa*.

Thorax greyish-white on anterior third, remainder white; legs white with exterior of fore and mid legs infuscated; forewing (fig. 5) with costa straight, apex pointed, termen slightly sinuate beneath apex and hardly arched, R_1 often connected with Sc by short bar and sometimes anastomosed with R_2; ground colour above shining white, orange-brown spot at base of costa, extreme costal, termen and posterior margins orange-brown, cilia orange-brown; hindwing shining white; subapical and subtornal fuscous spot present, cilia white; forewing beneath furtively infuscated; orange costal streak from near base to five-sixths, inner margin streak absent; hindwing beneath white, fuscous spots as above but larger; wing expanse ♂ 48–52 mm, ♀ 52–54 mm.

Male genitalia (fig. 23) with socii rather pendulous, apex of gnathos enlarged with numerous small spines surmounted by a larger single spine, furca relatively short with prongs of unequal length; aedeagus (fig. 33) with cornuti of two groups of small spines.



Figs 14–17. Pupa and cremaster of *Thalaina* spp. 14. *T. selenaea*; 15. *T. angulosa*; 16. *T. clara*; 17. *T. macfarlandi*.

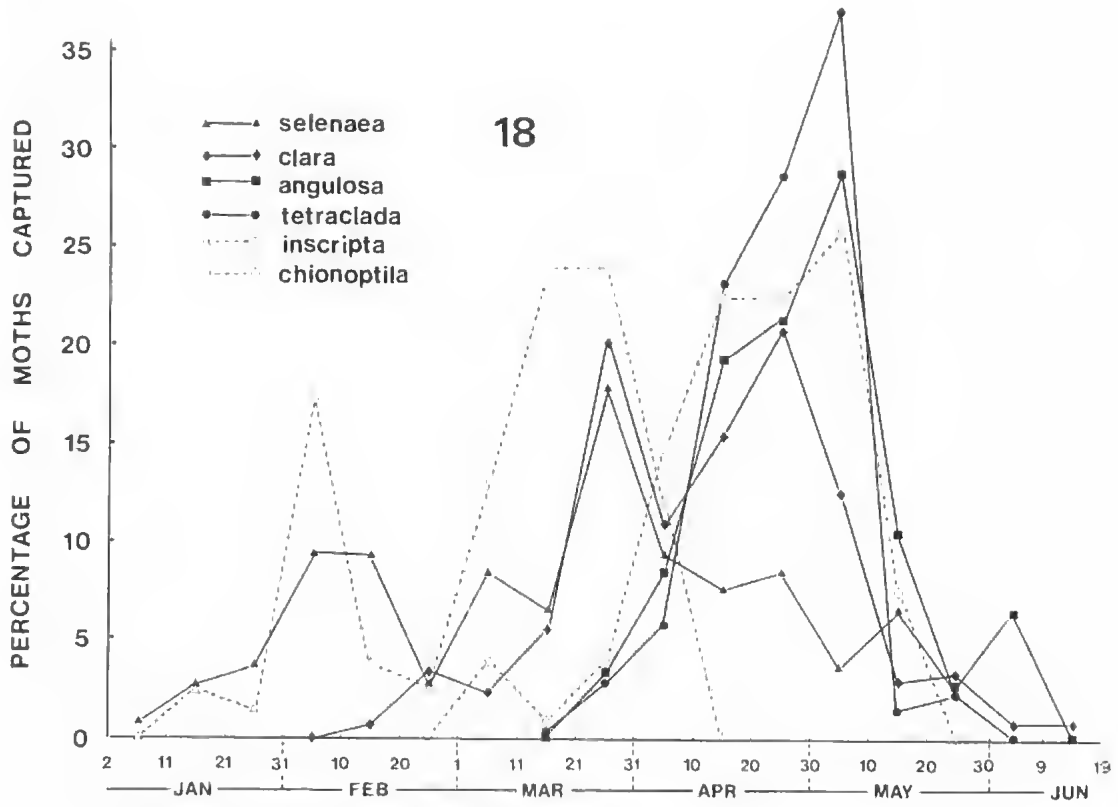


Fig. 18. Flight period of adults of some *Thalaina* spp.

Female genitalia (fig. 43) with collieulum rather broad.

Immature stages not recorded except that larva pupates underground.

Foodplant: Acacia harpophylla Benth.

Specimens examined: QUEENSLAND: Millmerran, iv., v. JM 5 ♂ 4 ♀, ANIC; Millmerran, iii., iv., v. JM 28 specimens, NMV; Millmerran, iv., v. JM 8 specimens, QM; Millmerran, iii., iv., v. JM 4 ♂ 8 ♀, SAM; Millmerran, iii., iv., v. JM 5 ♂ 4 ♀, UQ. NEW SOUTH WALES: Trangie, iv. RL t ♂, ANIC.

Distribution: see fig. 49. *Flight period:* see fig. 18.

Comments: T. chionoptila is mainly known from a long series of adults taken at Millmerran in the 1930's and 40s by J. Macqueen. Land clearing since then has much reduced the availability of its foodplant in southern Queensland. On present evidence it is the most localised member of the genus.

Thalaina tetraclada (Lower) comb. nov.
FIGS 1, 18, 24, 34, 44, 51, 58.

Amelora tetraclada Lower 1900, p. 406.

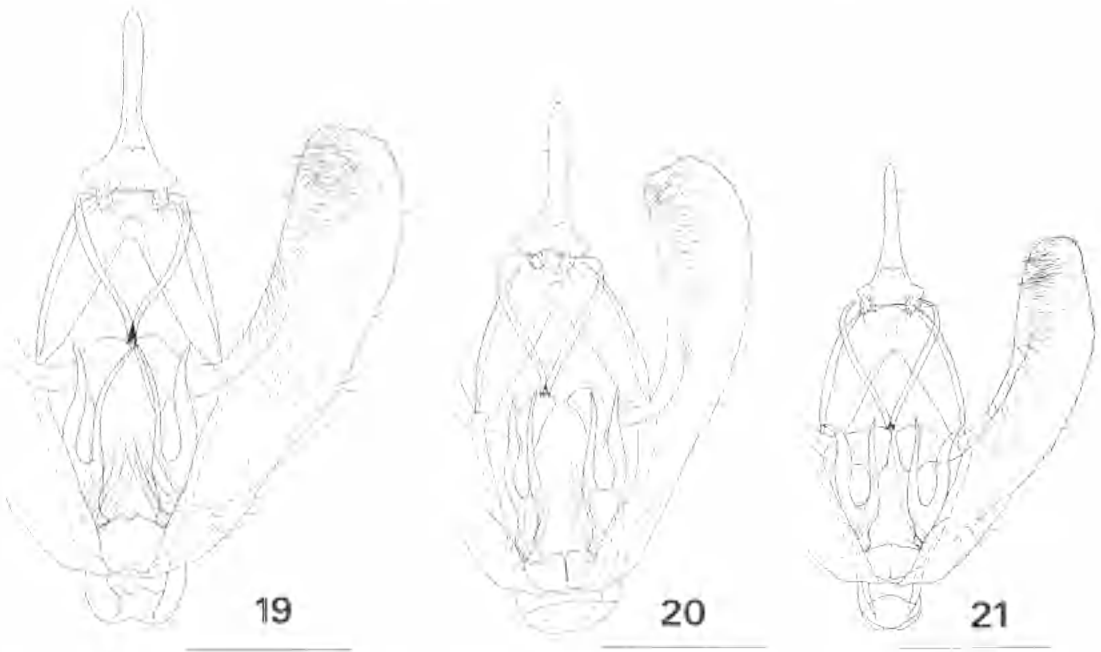
Thalainodes tetraclada Lower 1902, p. 231: Turner 1919, p. 386; Wilson 1972, p. 123.

Thalainodes nessostoma Turner 1919, p. 386; Wilson 1972, p. 123. *syn. nov.*

Holotype ♂ of *tetraclada* labelled "3459 TYPE Broken Hill 6.5.1899 : tetraclada Low. 3459", in Lower's hand, in SAM.

Holotype ♀ of *nessostoma* labelled "probably Bourke coll. Helms : Thalainodes nessostoma Turn. TYPE : G. M. Goldfinch Collection" in AM.

Adult (fig. 58): Head with frons naked and bearing rounded projection (fig. 1); vertex orange or tan; labial palp pale brown above, white below; antenna of male strongly bipectinate. Thorax orange or tan above with inner margin of tegulae and sides of thorax white; legs white, exterior of fore and mid femur and tibia and all tarsi infuscated; forewing with costa nearly straight, apex produced, termen gently arched and oblique, ground colour above shining white, orange or tan costal streak from apex to one-half costa attenuated anteriorly then continued as fine streak to base; faintly black-margined orange or tan streak



Figs 19–21. Male genitalia. 19. *T. selenaea*; 20. *T. angulosa*; 21. *T. clara*. Scale lines 1 mm.

from base to just above mid termen tracing M_3 and emitting similar streak from about one-fifth to one-third tracing CuA_2 to termen; streak along posterior margin from near base to tornus, termen narrowly orange or tan, cilia orange or yellow; hindwing shining white; large fuscous subapical blotch, projection of which often touches termen or is continued subterminally to anal angle, cilia white; forewing below white, lightly infuscated basally and below CuA_2, costa and termen narrowly orange or tan; fuscous subapical blotch posteriorly orange or tan; hindwing below shining white; maculation as above; wing expanse ♂ 38–48 mm, ♀ 38–46 mm.

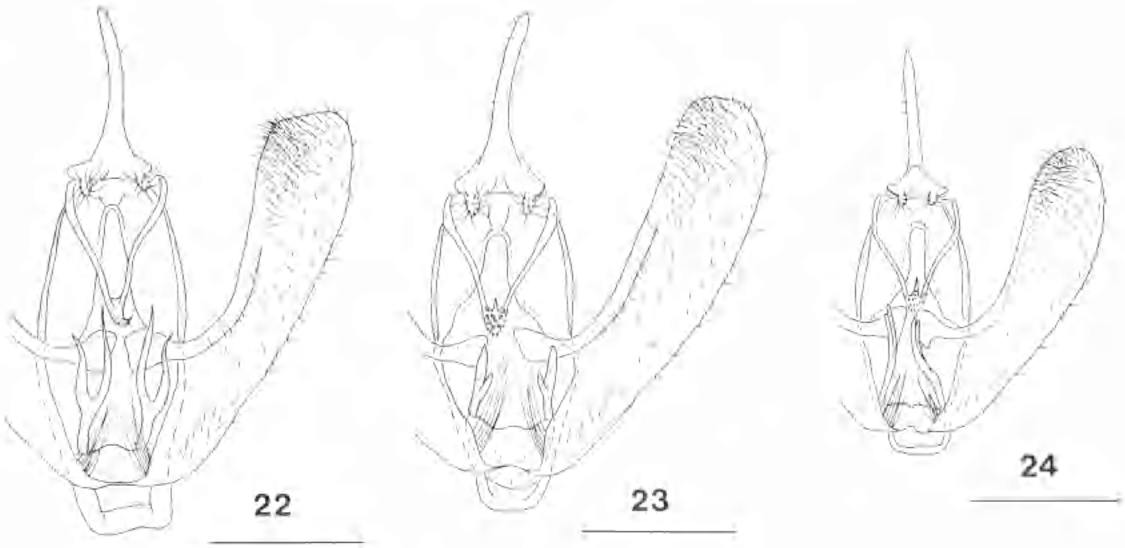
Male genitalia (fig. 24) with uncus rather long, gnathos with a large apical spine bearing numerous smaller ones, furca rather linear and both forks of equal length; aedeagus (fig. 34) curved basally, cornuti of two groups of about 3 spines.

Female genitalia (fig. 44) with apophyses anteriores rather short, colliculum longer than sclerotised band of ductus bursae.

Specimens examined: 37 ♂ 33 ♀ NEW SOUTH WALES: Broken Hill, v, OBL 2 ♂ SAM; Bourke, 1 ♀ AM; SOUTH AUSTRALIA: 10 km SW of Iron Knob, v, IFBC 4 ♂ 10 ♀ ANIC; 64 km E of Nullabor, iii, IFBC & MSU 1 ♂ ANIC; 89 km E of Nullabor, v, IFBC & MSU 1 ♂, 1 ♀ ANIC; 46 km SW of Whyalla, v, IFBC 4 ♀ ANIC; Whyalla, v, 2 ♀ NMV; WESTERN AUSTRALIA: 27 km SE of Coolgardie, iv, IFBC & MSU 3 ♂ 2 ♀ ANIC; Dalwallinu, iv, LEK 1 specimen WAM; Dumbleyung, iv, HU 2 specimens WAM; Kalbarri Nil Park, iv, IFBC & MSU 2 ♂ ANIC; Kojonup, iii, RJP 1 ♂, iii, RB 1 ♂, iv, ALR 5 ♂, iv, RJP 6 ♂ 2 ♀, iv, MMHW 3 ♂ 1 ♀, v, RJP 1 ♂, v, ALR 1 ♂, v, MMHW 1 ♂, all ANIC; 45 km W of Madura, iv, IFBC & MSU 2 ♀ ANIC; Merredin, LJN 1 specimen QM; 46 km W of Merredin, iv, IFBC & MSU 1 ♂ ANIC; 29 km W of Mogumber, iv, IFBC & MSU 1 ♀ ANIC; 97 km E of Norseman, iv, IFBC & MSU 1 ♀ ANIC; 24 km N of Northampton, iv, IFBC & MSU 3 ♂ 1 ♀ ANIC; Pithara, iv, IFBC & MSU 1 ♂ 4 ♀ ANIC; Tammin, v, 2 ♀ NMV.

Distribution: see fig. 51. *Flight period:* see fig. 18.

Comments: This species ranges widely across the subinterior of southern Australia, reaching the coast along the Nullabor Plain and southwest Australia. East of W.A. its range lies between the 20 cm and 35 cm isohyets whereas in southwestern Australia it extends to the 100 cm isohyet, apparently occupying the niche filled by the three forest species in southeastern Australia. Some clinal variation exists; specimens from the central and eastern parts of its range are usually smaller (mean wing expanse 40 mm) and the forewing markings



Figs 22–24. Male genitalia. 22. *T. inscripta*; 23. *T. chionoptila*; 24. *T. tetraclada*.

are tan or ochreous-orange, whereas in S.W. Australia they are usually larger (mean wing expanse 46 mm) and with bright orange markings. There are no genital differences between extremes of the cline.

Thalaina macfarlandi (Wilson) comb. nov.
FIGS 2, 17, 25, 35, 45, 51, 59.

Thalainodes macfarlandi Wilson 1972, p. 123.

Types: holotype ♀ labelled "NTHN. TERR., 148 km S of Alice Springs 26 April 1966 N. McFarland at uv light" in SAM; *allotype* and *paratypes*, see Wilson (1972).

Adult (figs 2, 59) adequately described by Wilson (1972); wing expanse ♂ 38–44 mm, ♀ 38–50 mm.

Male genitalia (fig. 25) with tegumen and valva elongate, apex of gnathos with large recurved spine bearing some smaller ones, furca goblet-shaped, juxta elongate; aedeagus (fig. 35) with apex produced, cornutus a sclerotised plate bearing small marginal spines.

Female genitalia (fig. 45) with very long ductus bursae and without sclerotisation.

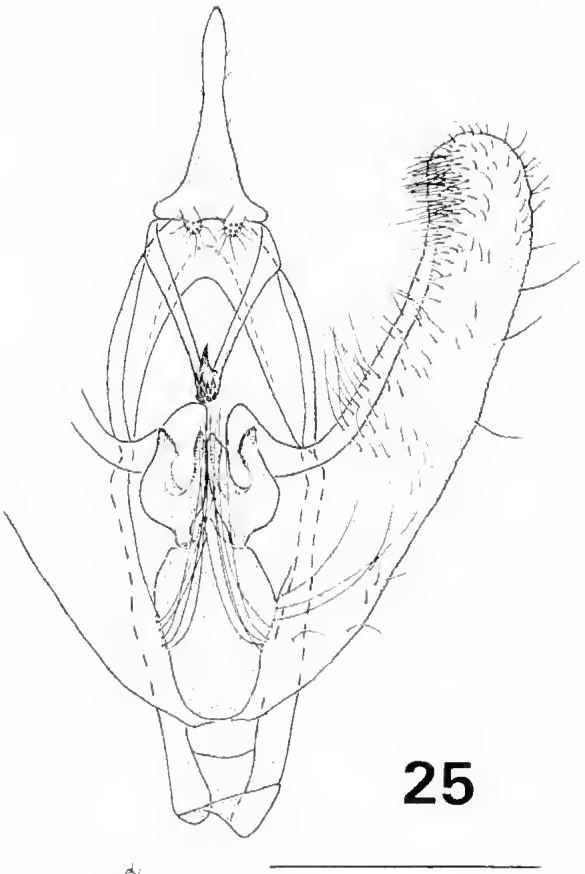
Egg ovoid, pale green with an elongated brown blotch, 1.0 mm long x 0.8 mm wide. Material: G180.

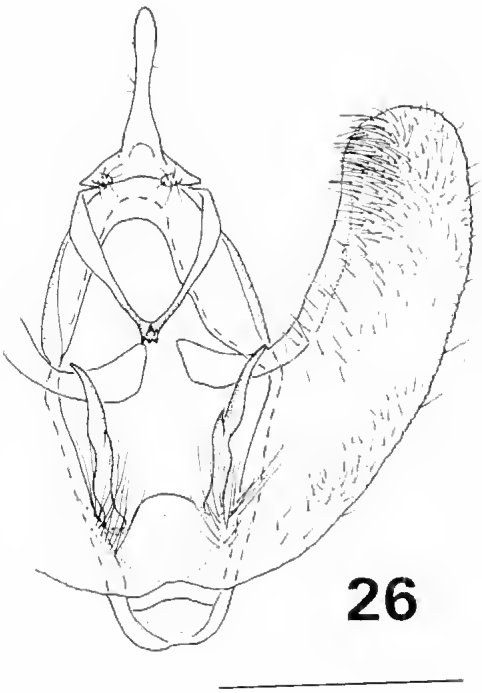
Final instar larva: Head capsule 3.3–3.4 mm wide, pale green with white band across vertex bearing many small fuscous blotches; body dull green, white lateral stripe strongly developed on pro- and mesothorax and again on A6 to A9 but usually poorly developed or absent on intermediate segments, spiracles black and placed above this line. L setae on A2 to A7 arising in black blotches on lower margin of lateral stripe, anal claspers with two black anterior vertical stripes, ventral areas pale green with two whitish subventral stripes on A7 and A8 only; crotchets 13–14 on A4, 14–15 on A5, 28–30 on A6 and 45–48 on anal claspers, those on hind claspers tending to be biordinal; length 27–31 mm, width 5.0 mm. Material: G180.

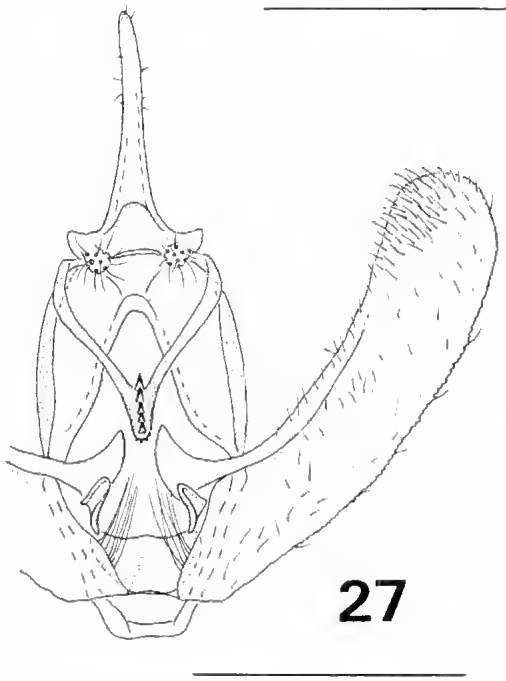
Pupa (fig 17) pale orange-brown; cremaster hooks 2; dorsal anterior margin of A10 with 2 lobes; length 11 mm, width 4.5 mm. Material: G180.

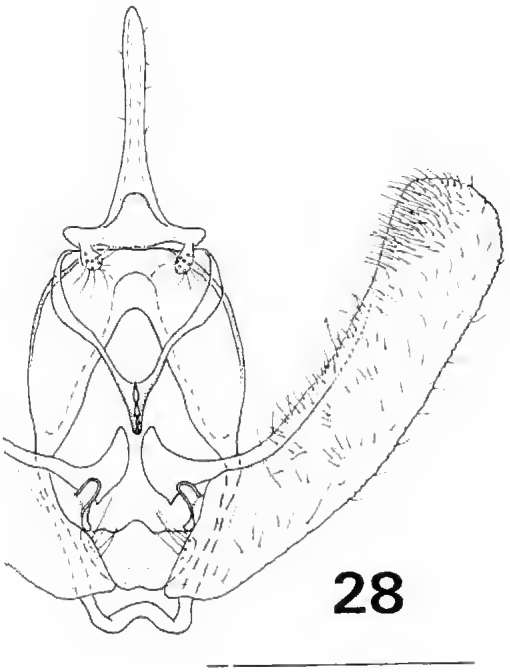
Foodplants: Unknown, but larvae thrive on *Acacia pycnantha* as a surrogate host (McFarland 1979).

Specimens examined: 14 ♂ 16 ♀. QUEENSLAND: Cunnamulla, v. NG 1 ♂ AM; 24 km S of Millmerran, iv. IFBC 1 ♀ ANIC. NEW SOUTH WALES: 30.50S 146.33E 23 km SSE of Byrock, v. EDE & MSU 1 ♂ 2♀ ANIC; Cobar, iv., v. VJR 2 ♀ ANIC; 29 km E of Vaughan Springs HS, vi. KJMcK 1 ♀ ANIC. SOUTH AUSTRALIA: 27.18S 133.25E Ammaroodinna Creek, v. PBMcQ 1 ♂ PBMcQC; 160 km NNW of Coober Pedy nr Wintinna, v. NMcF & TN 1 ♂ SAM; 61 km S of Kulgera, v. NMcF & TN 1 ♂ SAM. NORTHERN TERRITORY: 19 km E of Alice Springs, v. NMcF & TN 3 ♂ ANIC; 1 ♂ 1 ♀ AM, 1 ♀ BMNH, 1 ♂ 1 ♀ NMV; 45 km WSW of Alice Springs, v. NMcF & TN 1 ♀ SAM; 148 km S of Alice Springs, iv. NMcF

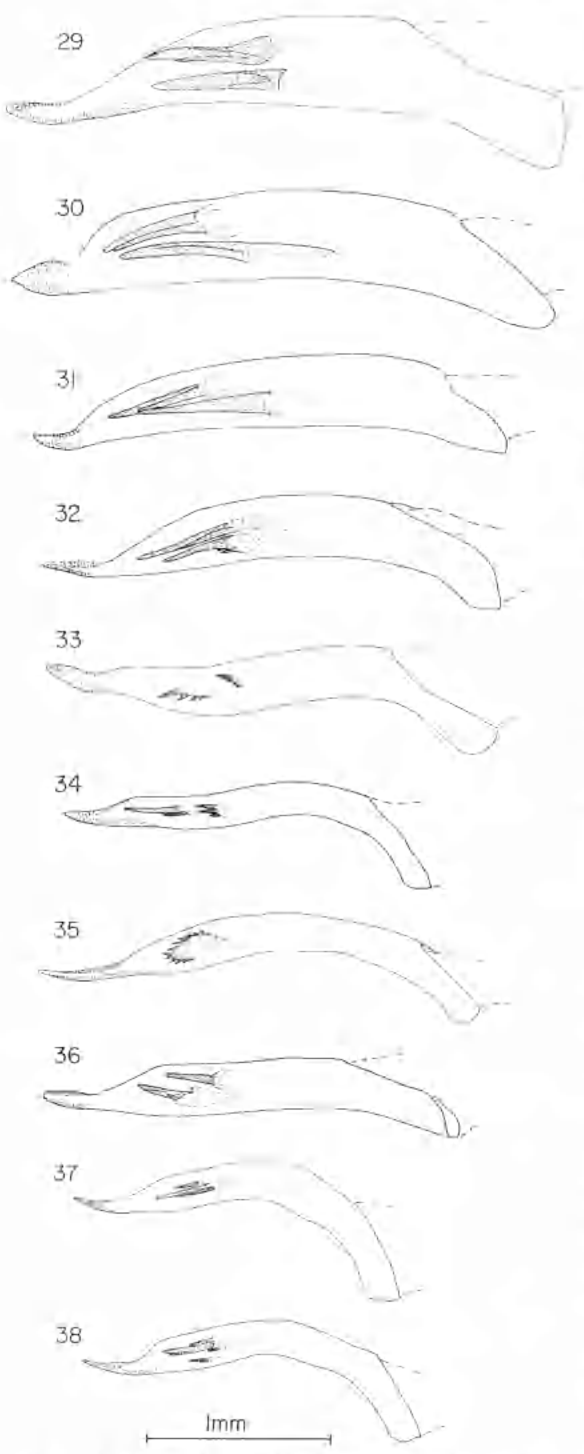








Figs 25–28. Male genitalia. 25. *T. macfarlandi*; 26. *T. kimba*; 27. *T. paronycha*; 28. *T. allochroa*. Scale lines 1 mm.



Figs 29–38. Aedeagi of *Thalaina* spp. 29. *T. selenaea*; 30. *T. angulosa*; 31. *T. clara*; 32. *T. inscripta*; 33. *T. chionoptila*; 34. *T. tetraclada*; 35. *T. macfarlandi*; 36. *T. kimba*; 37. *T. paronycha*; 38. *T. allochroa*.

1 ♀ SAM; 24.20S 131.35E Amadeus Basin nr Reedy Rockhole, vi. PR 4 ♀ ANIC; 23.48S 132.21E 5 km NE of Gosse's Bluff, v. HP 4 ♂ 1 ♀ ANIC.

Distribution: see fig. 51. *Flight Period:* late April to early June.

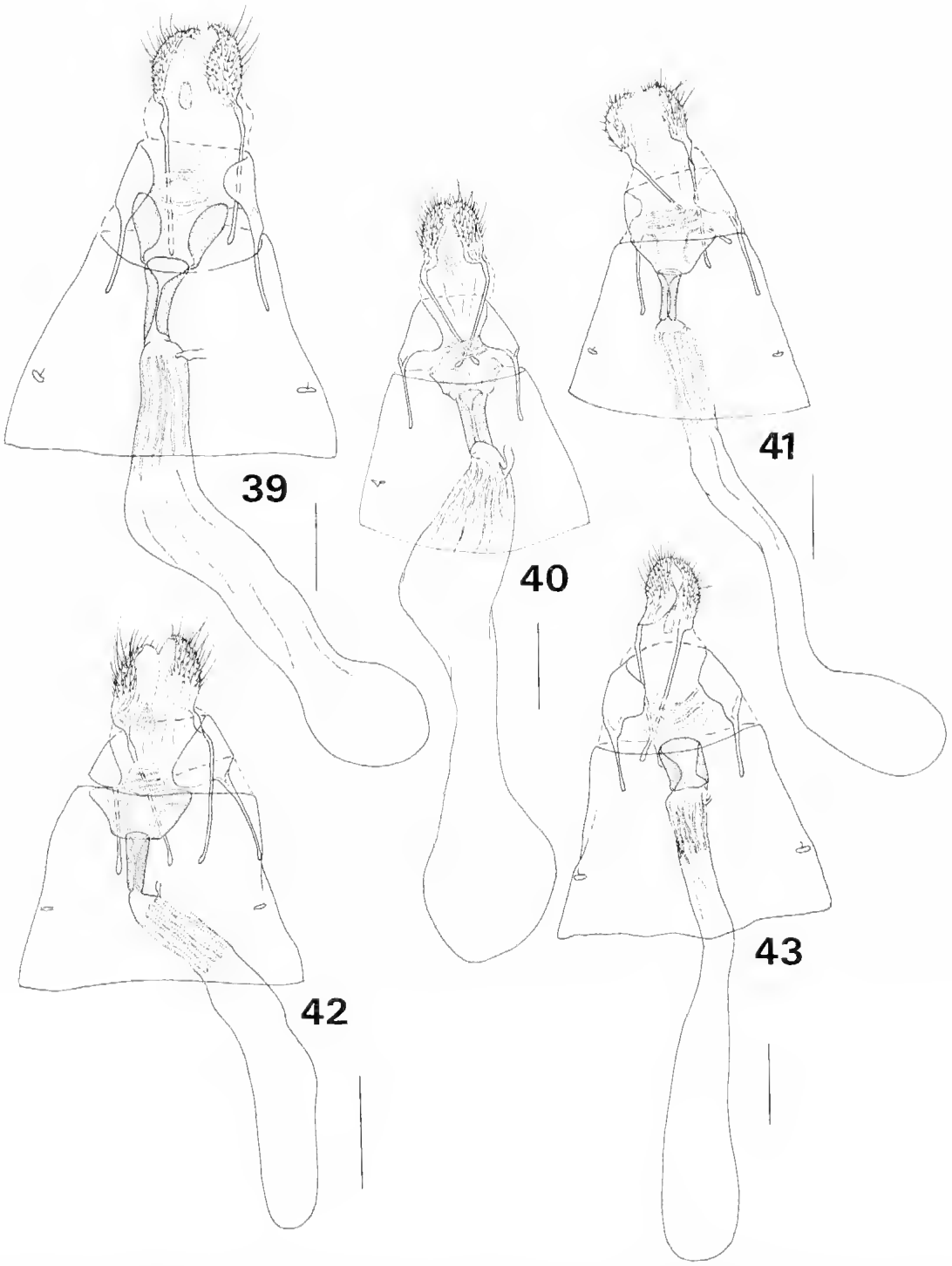
Comments: The dispersed nature of the few locality records for *T. macfarlandi* suggests a wide distribution in central Australia.

Thalaina kimba sp. nov.

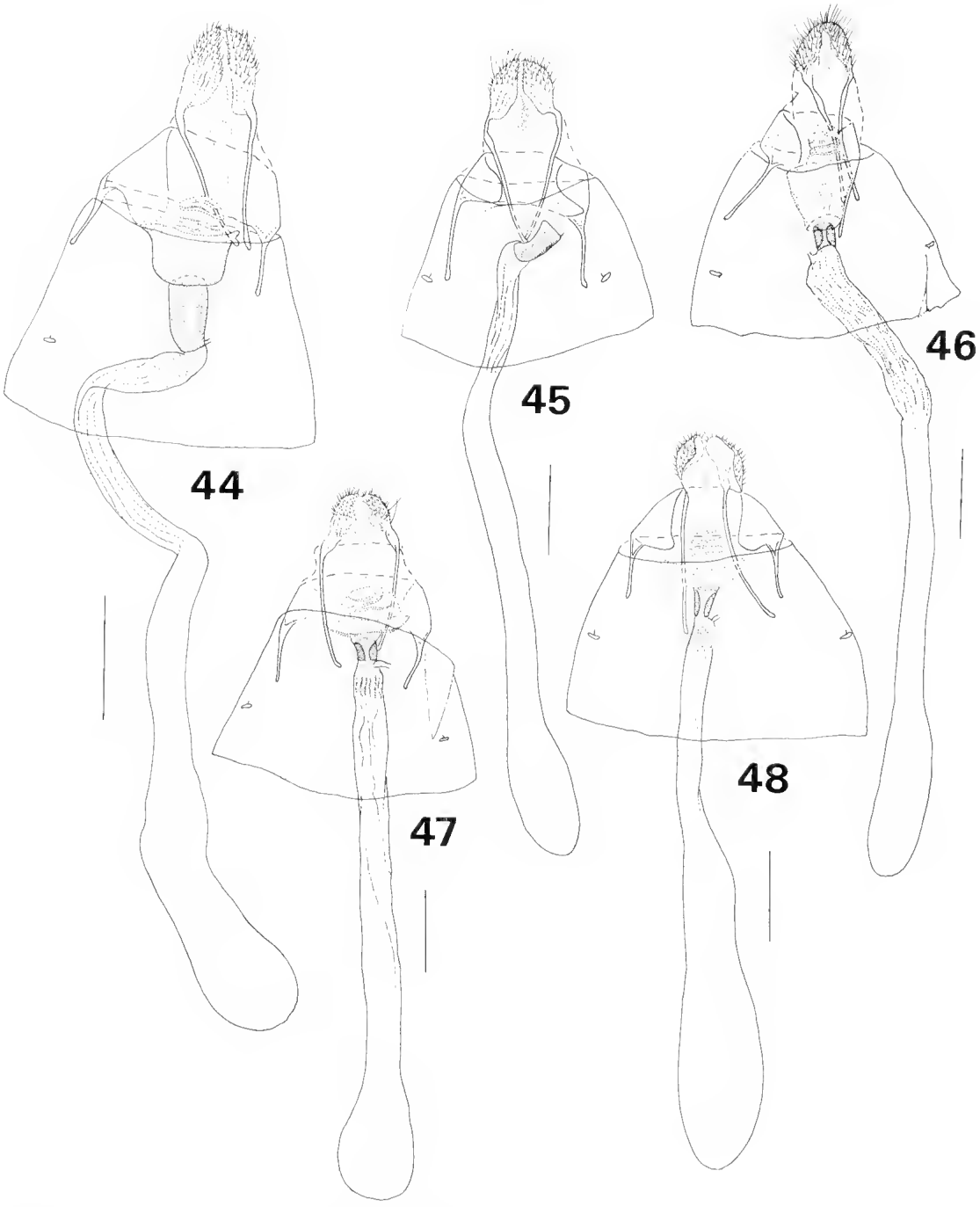
FIGS 11, 26, 36, 46, 51, 62, 63

Types: holotype ♂ labelled "32.51S 141.37E 100 km S by E of Broken Hill, N.S.W. 3 May 1976 I.F.B. Common E. D. Edwards: genitalia slide M846 PBMcQ 1978" in ANIC; 10 ♂ 8 ♀ *paratypes*, 2 ♂ same data as holotype, in ANIC; 1 ♂ labelled "6 miles S.W. of Iron Knob, S.A. 7 May 1970 I.F.B. Common: genitalia slide M842 PBMcQ 1978" in ANIC; 1 ♂ labelled "6 miles SE of Gol Gol, N.S.W. 5 May 1970 I.F.B. Common" in ANIC; 1 ♂ labelled "100 km SE of Broken Hill, N.S.W. 29 April 1976 I.F.B. Common E. D. Edwards" in ANIC; 1 ♂ labelled " 1 km NNW of Goolgowi, N.S.W. 5 May 1976 I.F.B. Common E. D. Edwards" in NMV; 1 ♂ same data as for previous specimen in SAM; 2 ♂ same data as for previous specimen in ANIC; 1 ♂ 1 ♀ labelled "33.23S 141.40E 82 km NW of Wentworth, N.S.W. 28 April 1976. I.F.B. Common E. D. Edwards" in BMNH; 1 ♀ labelled "31.49S 141.12E Umberumberka Reserve, 9 km NNW of Silverton, N.S.W. 1 May 1976 I.F.B. Common E. D. Edwards" in ANIC; 1 ♀ labelled "30.50S 146.33E 23 km SSE of Byrock, N.S.W. 8 May 1973 E. D. Edwards & M. S. Upton: genitalia slide M845 PBMcQ 1978" in ANIC; 1 ♀ labelled "Mambray Creek Nat. Park, S.A. 11 May 1970 I.F.B. Common: genitalia slide M843 PBMcQ 1978" in ANIC; 1 ♀ labelled "30 miles SW of Whyalla, S.A. 9 May 1970 I.F.B. Common: genitalia slide M822" in ANIC; 1 ♀ labelled "Kimba 12.5.1963 R. E. Harris" in SAM; 1 ♀ labelled "Minnipa, S.A. May 1970" in PBMcQ; 1 ♀ labelled "Moorunde Wombat Reserve, nr. Blanchetown, S.A. 12 May 1974 P. B. McQuillan" in PBMcQC.

Adult (Figs 62, 63): Head with frons naked, bearing long rectangular projection emarginate at apex; vertex of head rough-scaled, greyish with suggestion of fuscous transverse bar behind antennae; labial palpi with terminal segment white; antenna in male shortly bipectinate. Thorax with anterior and posterior thirds fuscous-grey, mid-third and tegulae pale grey; legs infuscated, except hind femur and tibia; forewing (fig. 11) with costa straight in male, slightly recurved in female, termen sinuate beneath apex and strongly arched, R_1



Figs 39–43. Female genitalia. 39. *T. selenaea*; 40. *T. angulosa*; 41. *T. clara*; 42. *T. inscripta*; 43. *T. chionoptila*. Scale lines 1 mm.



Figs 44–48. Female genitalia. 44. *T. tetraclada*; 45. *T. macfarlandi*; 46. *T. kimba*; 47. *T. paronycha*; 48. *T. allochroa*. Scale lines 1 mm.

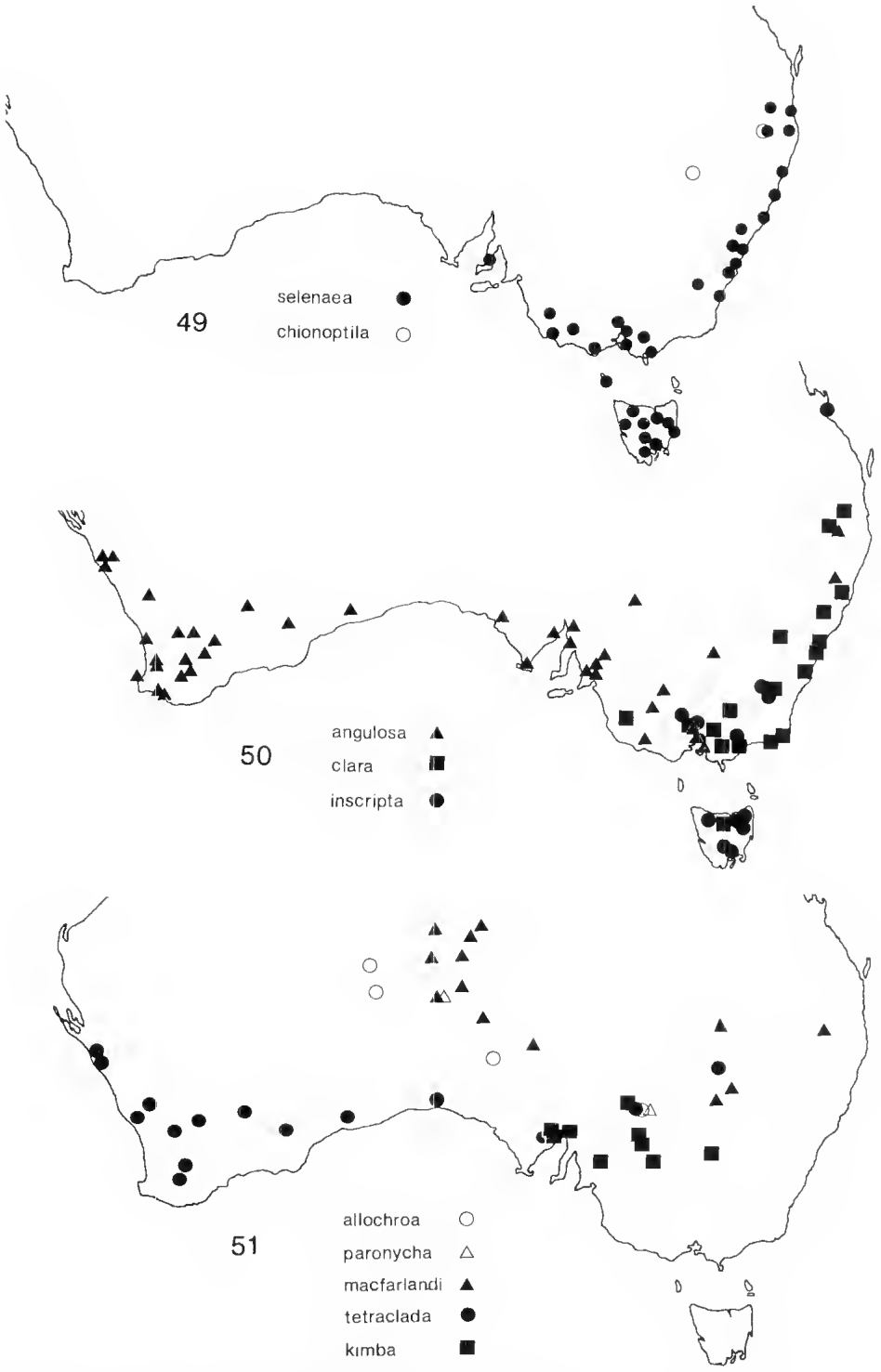


Fig. 49. Distribution of *Thalaina selenaea* and *T. chionoptila*.
Fig. 50. Distribution of *Thalaina angulosa, T. clara* and *T. inscripta*.
Fig. 51. Distribution of *Thalaina allochroa, T. paronycha, T. macfarlandi, T. tetraclada* and *T. kimba*.

anastomosed with Sc, ground colour white, markings suffused grey and sprinkled with bluish-white scales, base of costa blackish; very broad black-margined streak from one-third costa dilated posteriorly to mid disc where it bifurcates, one arm to mid termen thence angled to four-fifths costa and extending to half costa, other arm to tornus thence along posterior margin to near base where it is mixed with black; broad indented streak along termen, cilia brownish-grey becoming grey below M_3; hindwing translucent white with several irregular terminal and subterminal fuscous blotches; forewing beneath white with streak along posterior margin absent, discal streaks narrower and more sharply defined with fuscous, termen streak as above; hindwing beneath white, a subapical and a subtornal blotch only; wing expanse ♂ 38–44 mm, ♀ 40–44 mm.

Male genitalia (fig. 26) with valva rather broad, apex of gnathos with 3 or 4 small spines, furca long and sinuate with one branch poorly developed; aedeagus (fig. 36) with cornuti of single stout spine and group of 3 or 4 spines.

Female genitalia (fig. 46) with colliculum square, sterigma well developed, ductus bursae very long its proximal third with thick folds, remainder thinly membranous.

Distribution: see fig. 51. Probably widespread in mallee habitats from Eyre Peninsula through the Murray Mallee to western New South Wales.

Flight period: late April to early May.

Thalaina paronycha (Lower) comb. nov.

FIGS 9, 27, 37, 47, 51, 61.

Amelora paronycha Lower 1900, p. 407.
Thalainodes paronycha Lower 1902, p. 231; Turner 1919, p. 386; Wilson 1972, p. 123.

Holotype ♀ labelled "3460 TYPE Broken Hill 24.5.98" in Lower's hand, in SAM.

Adult (fig. 61): Head with frons naked, bearing moderate truncate projection with longitudinal rib beneath; vertex with ochreous hair-scales which extend almost to extremity of frontal projection; labial palpi whitish; antenna of male strongly bipectinate. Thorax ochreous above, whitish below; legs tinged ochreous, fore-tibia very short, bearing apical spine; forewing (fig. 9) with costa straight, apex pointed, termen moderately arched, R_1 anastomosed with Sc, ground colour shining white, markings dark ochreous or tan finely edged with brown, extreme costal edge white slightly broader from one-sixth to one-half costa; costal streak from base to apex narrowly continued along termen and slightly extended but broader along posterior margin; streak from one-quarter costa to termen above middle tracing M_3 thence angled on termen to costa at three-quarters; diagonal streak from half discal streak to just above tornus, cilia ochreous; hindwing shining white tinged ochreous, pale fuscous subapical spot, cilia white; forewing beneath white, tinged ochreous on basal half and on margins, pale fuscous diagonal subapical spot; hindwing beneath white, subapical spot slightly larger and darker than above, small faint fuscous spot near termen between CuA_2 and A_1; wing expanse ♂ 36–40 mm, ♀ 42–44 mm Adbomen ochreous.

Male genitalia (fig. 27) with tegumen broad, apex of gnathos elongate and bearing longitudinal row of about 6 stout spines, valva relatively long, furca reduced to small lobe; aedeagus (fig. 37) strongly curved, cornuti of single spine and another group of fused spines.

Female genitalia (fig. 47) with apophyses anteriores rather short, a band of sclerotisation at top of ductus bursae similar in length to colliculum, ductus bursae very long.

Specimens examined: 11 ♂ 26 ♀ NEW SOUTH WALES: Broken Hill, iv., v. OBL 10 ♂ 26 ♀ SAM, 11 specimens NMV; SOUTH AUSTRALIA: Ammaroodinna Creek 27.18S 133.25E, v, PBMcQ 1 ♂ PBMcQC.

Distribution: see fig. 51. *Flight period:* mid April to late May.

Comments: This and the next species are rather isolated from the rest of the genus by structural features such as genitalia, presence of a spine on the fore tibia and the form of the frontal process.

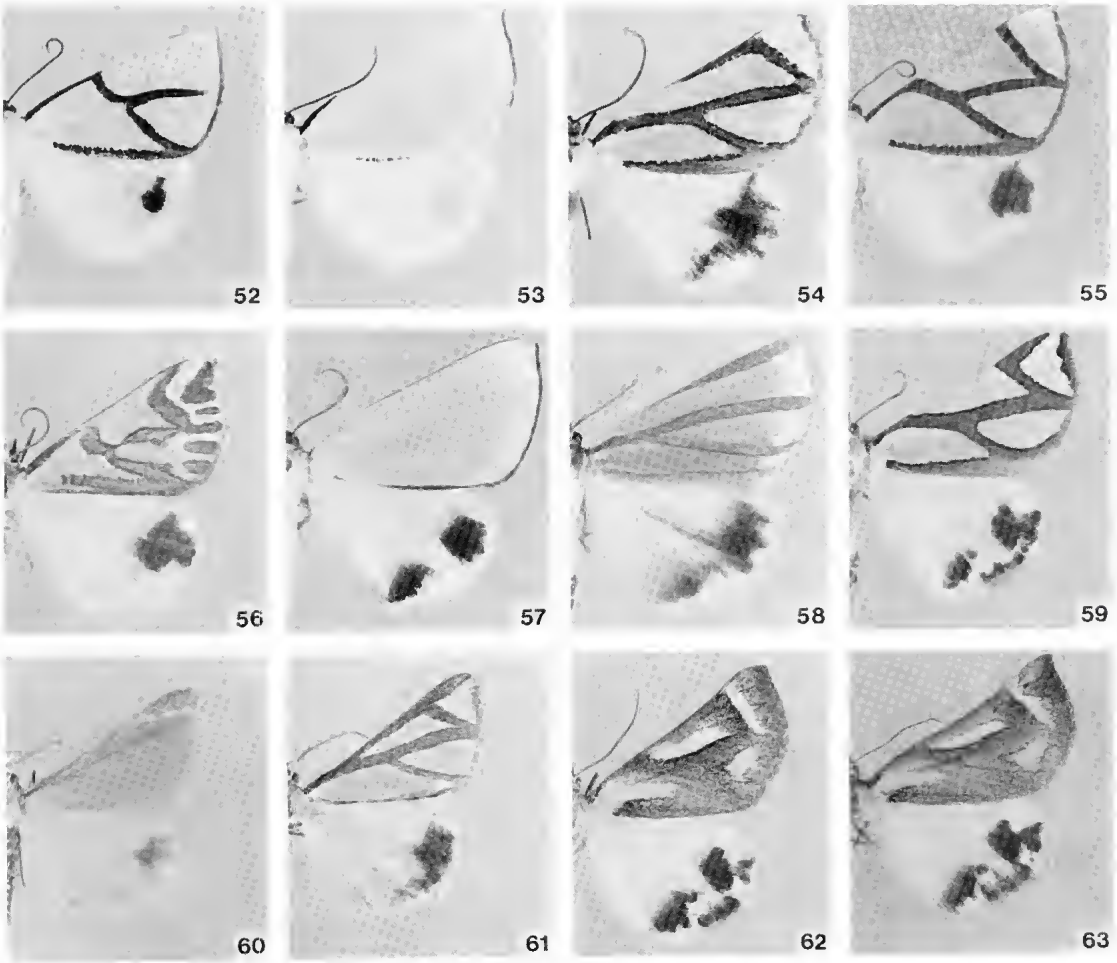
Thalaina allochroa (Lower) comb. nov.

FIGS 10, 28, 38, 48, 51, 60.

Thalainodes allochroa Lower 1902, p. 232; Turner 1919, p. 387; Wilson 1972, p. 123.

Holotype labelled "3.5.02 Broken Hill : 3779 : Amelora allochroa Lower TYPE" in Lower's hand, in SAM.

Adult (fig. 60) with head as for *T. paronycha*; vertex with ochreous-buff hair-scales which extend onto frontal projection; labial palpi white;



Figs 52–63. Adults of *Thalaina* spp. 52. *T. selenaea* ♂; 53. *T. selenaea* var. *punctilinea* ♂; 54. *T. angulosa* ♂; 55. *T. clara* ♂; 56. *T. inscripta* ♂; 57. *T. chionoptila* ♂; 58. *T. tetraclada* ♂; 59. *T. macfarlandi* ♂; 60. *T. allochroa* ♂; 61. *T. paronycha* ♂; 62. *T. kimba* holotype ♂; 63. *T. kimba* paratype ♀.

antenna of male strongly bipectinate. Thorax ochreous-buff above, whitish below; legs tinged ochreous; fore tibia very short, bearing apical spine; forewing (fig. 10) with costa straight, apex round-pointed, termen moderately arched, R_1 anastomosed with Sc, uniformly ochreous-buff, often sparsely flecked with black scales, extreme costal edge white especially between one-sixth costa and one-half, cilia ochreous; hindwing white, slightly ochreous tinged, pale fuscous subapical blotch emitting faint subterminal line to tornus, cilia white; forewing beneath whitish tinged with pale fuscous towards apex and costa; pale fuscous diagonal subapical spot; hindwing beneath white, subapical blotch slightly darker than above; wing expanse ♂ 36–44 mm. Abdomen ochreous.

Male genitalia (figs 28, 38) similar to *T. paronycha,* but apex of gnathos usually with 4 spines.

Female genitalia (fig. 48) almost indistinguishable from *T. paronycha.*

Specimens examined: 5 ♂ 2 ♀. NEW SOUTH WALES: Broken Hill, v. OBL 1 ♂ 1 ♀ NMV, v. OBL 6 ♀ SAM; Mootwingee Historical Site 31.14S 142.18E, v. IFBC & EDE 2 ♀ ANIC. SOUTH AUSTRALIA: Ammaroodinna Creek 27.18S 133.25E, v. PBMcQ 1 ♂ PBMcQC; McDouall Park, v. FWJ 1 ♀ SAM; Tallaringa Well, v. PA 1 ♀ SAM; 107 km S of Coober Pedy, v. NMcF 1 ♀ SAM. WESTERN AUSTRALIA: Giles, v. 2 ♂ PBMcQC; Skirmish Hill, 1 ♂ SAM.

Distribution: see fig. 51. *Flight Period:* May.

Comments: T. allochroa exhibits a radical departure from the basic colouration of the

genus but structurally it is virtually indistinguishable from *paronycha*. It is just possible that *allochroa* is only a Mendelian segregate of *paronycha* but breeding experiments are needed to confirm this. Though infrequently collected, both species appear to be widely distributed within the 15–25 cm isohyets south of 25° S latitude.

Discussion

There are no consistent venational, genitalic or other structural differences which justify the separation of *Thalainodes* Lower and *Macqueenia* Turner from *Thalaina* Walker.

The presence of an areole in the forewing is not correlated with any other features of diagnostic value beyond species level. An areole is present in one form in *selenaea*, in another form in *chionoptila*, *clara* and *inscripta* and is absent in the rest. Lower's impression of a longer cell in the hindwing of his *Thalainodes* is erroneous as measurement will show.

Some diversity exists in the male antennae: they are laminate with ventrally produced, ciliated segments in *selenaea*, *inscripta* and *clara*, shortly bipectinate in *angulosa*, *macfarlandi* and *kimba*, and strongly bipectinate in *allochroa*, *paronycha*, *chionoptila* and *tetraclada*. Earlier authors have previously overlooked the slight but definite bipectinate nature of the antennae of *angulosa*.

The corneous frontal process appears to have arisen independently several times in the genus, as it has in many other arid zone genera. This structure, in conjunction with the foretibial spines in *allochroa*, *paronycha* and *kimba*, probably assists the imago to find its way to the surface of the soil after emerging from the buried pupa.

A number of biological features are shared. All are late summer to late autumn fliers with an annual life-cycle. It is very likely that eggs of all species are stimulated to hatch by rain as *angulosa* is (McFarland 1973). Larvae are associated with *Acacia* (or less often *Cassia*) and where known, complete their feeding in early spring and pupate just below the surface of the ground where they over-summer. Pupal aestivation is a phenomenon shared by many autumn-flying ennomines in southern Australia, such as the species of *Chlenias* (Madden & Bashford 1977). *Thalaina* has successfully exploited a very wide range of habitats in the southern half of Australia, a few species having adapted to each major ecological zone within the overall range of the genus.

Previous attempts to fragment the genus have been based on either incorrect evidence or are unnecessary, since several other genera (e.g. one to contain *allochroa* and *paronycha*) could be erected on similar evidence. Therefore, I feel it is better to slightly expand the original definition of *Thalaina* to contain all of the above species, thus reflecting their close relationship.

Acknowledgments

I am indebted to Dr I. F. B. Common, C.S.I.R.O., for helpful discussions and comments on the manuscript and to Mr D. S. Fletcher, BM(NH), for generous assistance with information on type specimens and literature. A generous grant from the Royal Society of South Australia Research Fund enabled me to visit the Australian National Insect Collection, Canberra, for which I am grateful. Thanks are also due to the curators who loaned material or sent information, to Mr M. Potgeiter for photographs, and to Dr J. J. H. Szent Ivany and my wife Kathryn who helped in various ways.

References

DESMAREST, M. E. (1858) *In* Chenu, J. C., Encyclopédie d'Histoire naturelle — Table alphabetique: Lépidoptères. (Paris.)

DOUBLEDAY, E. (1845) Descriptions of some new Australian Lepidopterous insects. *In* E. J. Eyre, *Jls Expdns Disc. cent. Aust.* **1**: Appendix pp. 437-439, pl. 5.

FLETCHER, D. S. (1979) The generic names of moths of the world. Vol. 3. Geometroidea. I. W. B. Nye (ed.). (British Museum, London.)

GOLDFINCH, G. M. (1944) Notes on the Australian Boarmiidae and Oenochromatidae (Lepidoptera) with descriptions of new species. *Proc. Linn. Soc. N.S.W.* **69**, 189-192.

GUENÉE, A. (1857) Histoire naturelle des insectes: Species général des lépidoptères. Tome 10. Uranides et Phalenites II. pp. 1-584. (Rorel, Paris).

HERRICH-SCHÄFFER, G. A. W. (1855) Sammlung neuer oder wenig bekannter aussereuropäischer Schmetterlinge. Volume 1, Series 1. 26 Heft. 96 pl., figs 1-551.

LOWER, O. B. (1893) Descriptions of new Australian Heterocera. *Trans. R. Soc. S. Aust.* **17**, 287-293.

—— (1900) Descriptions of new Australian Heterocera. *Proc. Linn. Soc. N.S.W.* **23**(3), 403-423.

—— (1902) Descriptions of new genera and species of Australian Lepidoptera. *Trans. R. Soc. S. Aust.* **26**, 212-247.

LUCAS, H. (1857) *In* Chenu, J. C., Encyclopedie d'Histoire naturelle—Papillons diurnes, 310 pp., 40 pl., text illustr. (Paris.)

MCFARLAND, N. (1971) Egg photographs depicting 40 species of southern Australian moths. *J. Res. Lepid.* **10**(3), 215-247.

—— (1973) Some observations on the eggs of moths and certain aspects of first instar larval behaviour. *Ibid.* **12**(4), 199-208.

—— (1979) Annotated list of larval foodplant records for 280 species of Australian moths. *J. Lepid. Soc.* **33**(3), Suppl. 72 pp.

MADDEN, J. L. & BASHFORD, R. (1977) The life history and behaviour of *Chlenias* sp., a geometrid defoliator of radiata pine in Tasmania. *J. Aust. ent. Soc.* **16**(4), 371-378.

MEYRICK, E. (1892) Revision of Australian Lepidoptera V. *Proc. Linn. Soc. N.S.W.* **6**(2), 581-678.

THIERRY-MIEG, P. (1899) Descriptions de lépidoptères nocturnes. *Ann. Soc. ent. Belg.* **43**, 20-21.

TURNER, A. J. (1919) Revision of Australian Lepidoptera VI. (Third instalment.) *Proc. Linn. Soc. N.S.W.* **44**(2), 258-310 and 383-413.

—— (1947) New Australian species of Boarmiadae (Lepidoptera). *Proc. R. Soc. Qld* **58**(6), 71-112.

WALKER, F. (1855) List of the specimens of lepidopterous insects in the collection of the British Museum. Part 3, pp. 582-775. (British Museum, London.)

—— (1865) List of the specimens of lepidopterous insects in the collection of the British Museum. Part 31. Suppl. pp. 1-321. (British Museum, London.)

WILSON, J. O. (1972) A new species of *Thalainodes* (Lepidoptera: Geometridae: Ennominae) from central Australia. *Mem. Natl Mus. Vict.* **33**, 123-124, pl. 11.

A NEW SPECIES OF MANAYUNKIA (POLYCHAETA) FROM EPHEMERAL LAKES NEAR THE COORONG, SOUTH AUSTRALIA

BY PAT HUTCHINGS, PATRICK DE DECKKER & MICHAEL C. GEDDES

Summary

The polychaete Manayunkia athalassia n.sp. is described from ephemeral lakes adjacent to the Coorong Lagoon, South Australia. This is the first record of this genus from Australia. Manayunkia athalassia is active over a wide range of salinities (27-95‰) and persists in dry lake beds during the summer months.